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No. 1—1880.

COLLEGE LIBRARIES AS AIDS TO INSTRUCTION.

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LETTER.

DEPARTMENT OF THE INTERIOR,
BUREAU OF EDUCATION,
Washington, January 20, 1880.

SIR: About three years ago this Office published a special report on the history, condition, and management of public libraries in this country. This work exerted a great influence on the growth, increase, and varied uses of public libraries. Especially notable among these uses is the increased employment of libraries as instruments of practical education, an instance of which has become well known by the publication of the felicitous address of Mr. Charles Francis Adams, jr., on the proper use of the library in connection with the public school system.[1] Another form of usefulness, that in connection with collegiate and university instruction, is exhibited in the two papers which accompany this letter.

The first is by Prof. Justin Winsor, librarian of Harvard University, the second by Prof. Otis H. Robinson, librarian of the University of Rochester. Professor Winsor endeavors to show how a very large library may by utilized in assisting the training of a collegiate course Prof. Robinson's paper is an excellent description of the way in which a smaller collection of books may be managed so as to produce the most beneficial effects on the mental habits, training, and progress of college students. Each has a problem to solve. One or the other difficulty confronts every college possessed of a library and desirous of using it as an educational force.

The usefulness of these papers, however, is not confined to colleges; they will be found suggestive to all librarians who are alive to their higher duty as guides in the art of reading.

I have the honor to recommend their publication as a circular of information, and am, sir, very respectfully, your obedient servant,

JOHN EATON,
Commissioner.

The Hon. SECRETARY OF THE INTERIOR.

Approved, and publication ordered.

C. SCHURZ,
Secretary of the Interior.

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[1] The New Departure in the Common Schools of Quincy, and other papers on educational topics. Boston, 1879.

COLLEGE LIBRARIES AS AIDS TO INSTRUCTION.

THE COLLEGE LIBRARY.

By Professor JUSTIN WINSOR, *Librarian of Harvard University.*

President Eliot, in writing of the Harvard Library in a recent report, spoke of its "having a profound effect upon the instruction given at the university, as regards both substance and method: it teaches the teachers." And yet, I fear, we have not discovered what the full functions of a college library should be; we have not reached its ripest effects; we have not organized that instruction which teaches how to work its collections as a placer of treasures. To fulfil its rightful destiny, the library should become the central agency of our college methods, and not remain a subordinate one, which it too often is. It is too often thought of last in developing efficiency and awarding appropriations; committed very likely to the charge of an overworked professor, who values it as a help to his income rather than an instrumentality for genuine college work; equipped with few, or even without any, proper appliances for bibliographical scrutiny; and wanting in all those administrative provisions that make it serviceable to-day and keep it so to-morrow.

There is often a feeling that books are, or ought to be, sensible enough to maintain their own ranks, without the need of a drill sergeant. A good deal of the librarian's work is doubtless that of the drill sergeant; but the genuine custodian of a library knows that his best work is a general's, who has campaigns to plan and territory to overrun; in other words, he has got to force his ranks into action, and make each book do the work for which it was made. Books skulk. Few are aggressive and compel attention, unless the librarian puts each on its own vantage ground.

In all this the librarian becomes a teacher, not that mock substitute who is recited to; a teacher, not with a text book, but with a world of books. The man is but half grown who thinks a book is of no use unless it is read through and would confine his acquaintance to the few score or hundreds of volumes that he can conscientiously read from beginning to end in a lifetime. One may indeed have a few books that remain a constant wellspring to him; but these should be very few, unless he wishes to have his conceptions dangerously narrowed. There is nothing so broadening as an acquaintance with many books, and nothing so improving as acquiring the art of tasting a book, as the geologist takes in the condition of a landscape at a glance. Let your few bosom books

qualify your intellectual nature; and then give yourself the food you will grow upon by the widest discursiveness. The way to avoid being appalled at the world of books is what the library of the college is commissioned to point out. Nothing is more certain than that the so called text book is really more the author's predilections of a subject than a true exposition of it. I would not certainly underrate the advantage often to come from any subject being passed into the alembic of an author's individuality; but it is not all: the subject as a virgin creation still attracts us. We must often get it from many angles, and it is the many books that give us this.

I will not now stop to discuss the thraldom or, if you choose, the practical necessity of the class system. It is quite true, however, tha the arguments for it have resulted in the text book—something that hits an average, with a void on either side of it.

I will not say that the library is the antagonist of the text book: but it is, I claim, its generous rival and abettor, helping where it fails and leading where it falters. If this is so, it follows that we must build our libraries with class rooms annexed, and we must learn our ways through the wilderness of books until we have the instinct that serves the red man when he knows the north by the thickness of the moss on the tree-boles.

I do not write this as a piece of idealism. I know it to be practical. It needs indeed time, money, industry, skill, patience, but it can be done. You may count the time and doubt the expediency; you may reckon the money and ask where it is to come from; you can promise industry; you hope for skill; you may question if your patience will hold out; but, with all these saved or acquired, it can be done.

The proposition then is to make the library the grand rendezvous of the college for teacher and pupil alike, and to do in it as much of the teaching as is convenient and practicable. This cannot be done with a meagre collection of books indiscriminately selected, with an untidy, ill lighted, uncomfortable apartment. The library should be to the college much what the dining room is to the house—the place to invigorate the system under cheerful conditions with a generous fare and a good digestion. It may require some sacrifices in other directions to secure this, but even under unfavorable conditions the librarian can do much to make his domain attractive. As he needs the coöperation of his colleagues of the faculty, his first aim is to make everything agreeable to them, and himself indispensable, if possible. College faculties are made up much as other bodies are—the responsive and sympathetic with those that repel and are self-contained. A librarian shows his tact in adapting himself to each; he fosters their tastes; encourages their predilections; offers help directly where it is safe, accomplishes it by flank movements when necessary; does a thousand little kindnesses in notifying the professors of books arrived and treasures unearthed.

In this way suavity and sacrifice will compel the condition of brotherhood which is necessary and is worth the effort.

With the student also the librarian cannot be too close a friend. He should be his counsellor in research, supplementing but not gainsaying the professor's advice. It would be a good plan to take the students by sections, and make them acquainted with the bibliographical apparatus, those books that the librarian finds his necessary companions, telling the peculiar value of each, how this assists in such cases, that in others; how this may lead to that, until with practice the student finds that for his work he has almost a new sense.

I am afraid few librarians not brought up amid an affluence of such reference books understand all that they can accomplish. It is too much to expect more than a very few college libraries to be equipped with such books by the thousands — twenty thousand would not be too many for perfection — but there is much that is bought for libraries that would be best postponed until the librarian can offer such instruction to the students with a well balanced if not large bibliographical and reference collection at his hand.

Let me enumerate a few of the books that every librarian will cite among those of chiefest importance to him, and such as it is a pity every student has not a working knowledge of.

When we consider the broad field of all languages and all subjects, we must probably give the first place to Brunet's *Manuel du Libraire*, the last edition of which (Paris, 1860–1865) is now being completed with some supplemental volumes. A book must have a certain prominence before Brunet chronicles it. This work is in its main body alphabetical by authors, but there is a classified topical key in the last volume. In some respects there is a more ample record in *Græsse's Trésor de livres rares et précieux*, but it is without subject clews.

If we deal with foreign languages and literatures, we must know also how to use Quérard's various bibliographies — his *La France littéraire* and *La littérature française contemporaine*, which with Lorenz's *Catalogue général*, 1840–1865, make a record covering 1700–1865. In German the chief help is Heinsius's *Allgemeines Bücher-Lexikon*, beginning 1700; but its many supplements make it inconvenient in use. Kayser's *Vollständiges Bücher-Lexikon*, beginning 1750, has the preference for those who wish to use a subject index. Notice of other languages is hardly called for with the present purpose.

On the English helps I must be fuller. Watt's *Bibliotheca Britannica* is arranged by authors and by subjects, but contains nothing later than 1820. Its topical arrangement gives it often advantages over Lowndes, who cannot in all ways be said to supersede it. Bohn's edition of Lowndes's *Bibliographer's Manual* is the best to have, with all its faults; but it is an arrangement by authors only. Its eleven parts as issued are sometimes bound in six volumes. Lowndes published the work originally in 1834, and Bohn began the new edition intending simply to

revise and add to Lowndes's entries; but as the work went on, Bohn extended his scheme, and the later volumes are much fuller than the first, and they contain the record of various writers whom Lowndes had ignored. In this way it is a pretty good register of authors who appeared before 1834, chronicling for about thirty years later their newer publications and editions of older works. The article on Shakespeare, for instance, is much elaborated, and is one of the best of the Shakespearian bibliographies, and it extends into other languages. The eleventh part of Bohn, in his sixth volume, is the only convenient record we have of the publications of societies and printing clubs, of private presses, and of similar exceptional issues.

Allibone's *Critical Dictionary of English Literature* is indispensable. It is useful biographically as well as bibliographically, but as there was an interruption in the printing the user must bear in mind that up to the letter O the record is not later than 1858, while after that it is in some parts as late as 1870. The author frequently gives under another writer, whom he may be treating of, sometimes with appositeness and sometimes with hardly any, addenda to articles which had already passed in the printing. Though a large part of the third volume is made up of indexes, which nobody uses, no index is given to these continuations, and they are lost unless the user makes his own index to them. They are of this kind: Under Syntax, the pseudonym of Combe, the record of his publications is continued, and as John Camden Hotten chanced to edit an edition of Dr. Syntax's Tour occasion is taken to introduce a long list of Hotten's editions, to supply a deficiency under H.

These two books, Allibone and Bohn, are those chiefly to be commended; but for the publications of the day they need to be supplemented with Whitaker's *Reference Catalogue of Current Literature* for English books and with Leypoldt's *Uniform Trade List Annual* for American ones.

For books distinctively American in text or print, and which were still in the market in 1876, the *American Catalogue* is as nearly a complete guide as it is practicable to make. This catalogue will have, when completed, a topical index. Such a subject aid is at present found to a much less extent, but for small libraries quite sufficient, in F. B. Perkins's *Best Reading*. For older English books, particularly for those of too transitory an interest to find place in the bibliographies, there may be occasion to consult the various publications known as the *London*, *English*, and *British Catalogues;* also, such similar publications as Low's *Index* and the *Bibliotheca Londinensis;* and even the lists of current books printed from month to month in the *Gentleman's* and the *London Magazines* in the last century. So, for the older American books, one has to consult the list giving those back of 1776, appended to the last edition of Thomas's *History of Printing*, Trübner's *Bibliographical Guide*, and Roorback's *Bibliotheca Americana*, 1820–1860, continued by Kelly in his *American Catalogue.*

The skilled librarian sees that I have given but the rudimental sources for research, and that the foreign languages admit in some cases of even finer details than the English. I have mentioned such, however, as it were well everybody having to do with books should know something of.

It is further true that there is generally a great lack of knowledge of the most common books of reference, with little understanding of the help they can be in literary research for the sources of knowledge. I always know a man who has learned to work in a great library by the aptness of his choice of books of reference in any emergency. All things considered, the most useful of these books, and the surest to respond to one's wants, is Larousse's *Grand dictionnaire universel du XIXe siècle*. It is an immense conglomeration of matter, and its fine but legible printing occupies sixteen large quarto volumes. Its cost may shut it out from the smaller libraries, but it is worth some sacrifice to get. The *Encyclopædia Britannica* can be much more easily dispensed with, and, notwithstanding the authoritative character and fulness of its articles, it will not compare with Larousse for genuine encyclopædic value.

I can hardly conceive a college library in fit trim that has not one or more of the principal encyclopædias now current, like Appleton's *New American Cyclopædia*, Chambers's *Encyclopædia*, and Johnson's *New Universal Cyclopædia*—each good in its way. Appleton is naturally preferable for many American topics and is better supplied with illustrations. Chambers is better on British subjects. Johnson, however, gives you more for your money than either of the others, and is an excellent working reference book. Of those in foreign languages, after Larousse, the great German *Conversations-Lexikon* of Brockhaus, which is in some sense the parent of the modern cyclopædia, is the first choice. There are various other cyclopædias which are desirable companions, and some of them have a distinctive value. It is perhaps not of so much consequence which one we use as it is to use some one constantly. They often help one by their references to the best literature on a subject. For instance, in all matters appertaining thereto we shall find very full and well assorted references in McClintock and Strong's *Cyclopædia of Biblical, Theological, and Ecclesiastical Literature;* a chief use of Allibone's *Dictionary of Authors* is for its references. For a compact general dictionary of biography and mythology, Thomas's *Biographical Dictionary* has no superior, and he guides you to the sources of his information. Hœfer's *Nouvelle biographie générale* has ample notes for further inquiry.

The indexes of the important periodicals should always be kept in mind. There are two convenient lists of such indexes, one in the initial publication of the new Index Society, Wheatley's *What is an Index?* and the other in the little *Handbook for Readers*, issued by the Boston Public Library. Poole's *Index to Periodical Literature*, though nearly thirty years old, is a necessary adjunct to the reference shelves, and the

new edition, now in progress under the joint action of American and British librarians, will add a new resource for the inquirer.

Of the great mass of library catalogues, a few principal ones stand out as distinctively and characteristically useful, and experience soon discloses them. As a general rule the subject catalogue of a large collection is a peculiarly American product; though some of the principal European libraries are giving signs of efforts in a like direction. Meanwhile in Britain, the Advocates' Library at Edinburgh, the Bodleian at Oxford, and several sectional publications of the British Museum are of constant use in a well equipped catalogue room. The publications of the latter institution include their catalogue for the letter A, which Panizzi put a stop to forty years ago; the catalogues of the King's and of the Grenville collections; and the very useful list of twenty thousand volumes which form the handy reference collection of their great reading room.

Of the continental libraries it is enough for our present purpose to name the chronological and classified catalogue of French history and biography, prepared at the great library in Paris.

Of the American library catalogues I can be more particular. Those of the *Public Library of Boston* are probably the best known, beginning with the Bates Hall Indexes, two volumes, and including those of the *Ticknor* and *Prince Collections* and of the *Barton Collection*, still unfinished. This library has also issued for more general use annotated *Class Lists of History, Biography and Travel, and Fiction*, making, with their critical, descriptive, and advisory notes, the earliest examples of what has since been called the Educational Catalogue.

For assistance to scholars, however, we can hardly boast anything better than the great *Catalogue of the Boston Athenæum*, of which three volumes, bringing it to the letter M, are now published, and into which Mr. Cutter, an exemplar in such work, is putting his careful and discriminating scholarship.

The *Subject Catalogue of the Library of Congress*, 2 volumes, 1869, and later authors' lists with subject indexes disclose the assiduous care which Mr. Spofford is bestowing upon the national collection.

The student, however, will rarely find for his ordinary work any catalogue to stand him in better stead than Mr. Noyes's classified *Catalogue of the Brooklyn Library*, and he will regret its present incompleteness, which, it is to be hoped, will not long continue. The Brooklyn Library will not rank with our larger libraries, but it is a good one, and this catalogue forms a better key to it than belongs, in print, to any other of our collections. It follows the Boston catalogues in giving annotations, though not to the same extent; but its references to periodical articles are more systematic, and in this respect it constitutes much the best single continuation of Poole's Index. It can be supplemented in some ways by the *Catalogue of the Public Library of Quincy, Mass.*, which has other features to warrant its taking a place on our nearest reference shelf. I should not pass from this topic without mentioning the *Catalogue of the*

Astor Library, 4 vols., 1857–1861, with a supplement in 1866, an authors' list, with a condensed index of subjects; the *Catalogue of the Philadelphia Library*, 3 vols., 1856, which is well indexed.

There is no occasion now for my mapping out the limits of the science of bibliography, but I simply give a reference to the article upon it in the *Encyclopædia Britannica*, 9th ed., vol. iii. It is the key to all knowledge and the sparer of unfruitful pains. Can there be any instruction fitter for our colleges? There is scarcely any department of learning so little attended to. There is nothing to indicate its scope later than Dr. Petzholdt's *Bibliotheca Bibliographica*, 1866, and an examination of this thoroughly German specimen of erudition will teach one what it is to be a bibliographer. Dr. Petzholdt divides his subject into eight heads, covering all languages:

1. General literature.
2. Anonymous and pseudonymous works.
3. Incunabula.
4. Works prohibited by censors.
5. Works on or by particular persons.
6. Engraved portraits.
7. National literature.
8. Classed literature.

There are two minor lists of classed bibliographies, sufficient for most purposes, in Nichol's *Handbook for Readers at the British Museum* and in the *Boston Public Library Handbook* already referred to. Supplementing these, the librarian will do well to watch the *Bulletins* and other *Bibliographical Contributions* of Harvard College Library, the Boston Public Library, the Boston Athenæum, and the Lenox Library. Nor can the librarian fully keep abreast of the literary progress without a file of the *Publishers' Weekly* of New York, the *London Bookseller*, the *Bibliographie de la France*, and similar publications of the other modern languages.

I have dwelt upon these extraneous helps because they are something that care and money can procure at the outset. The librarian's great labor, however, the ever accumulating evidence of his devotedness, is something that money will not buy off-hand, but comes, after much pains and never ending assiduity, in the catalogue of his own library. I can hardly here fully indicate the variations of the vexed question of the catalogue, which librarians will always discuss and rarely come to conclusions upon. It may be desirable that some determinations should be reached, but it is by no means necessary to the end in view. All catalogues, if there is a reasonable application of common sense in their construction, are fitted to do good work, and there is no doubt that a good catalogue thoroughly understood is better than a superior one whose principles have not been mastered. That comprehensive Report on American Libraries, issued by the Bureau of Education at Washington in 1876, contains a paper on catalogues by Mr. Cutter, and a code of rules for cataloguing, admirably exemplified by the same authority. This code, which is so thoroughly fashioned that it

has become an authority everywhere, will disclose to any one who examines it a new field of intricate knowledge, and it will broaden the conceptions of any one who is destined to a life of mental action.

If the librarian and his coadjutors, the instructors of the college, are to work for a common end effectually, the collection gathered about them must be catalogued. This means no rough work of the auctioneer's kind, but scholarly and faithful inquiry embodied in a fixed and comprehensive method. Every book must be questioned persistently as to its author, its kind, its scope, its relations to all knowledge. Answers to all these questions must be made record of, once for all. Let not the cost frighten; a library without such an index is no library, but a mob of books.

My own preference is to have the authors and subjects catalogued in one alphabetical arrangement, on what is called the dictionary system, of which the best examples are found in the printed catalogues of the Boston Athenæum and of the Boston Public Library. The plan doubtless has disadvantages; but for the general user it presents clews that are most easily followed, and carries in large part its own key. For the skilled and habitual user, classed catalogues, especially those in which related subjects stand in close propinquity, may be more satisfactory; but such users are always rare. Both kinds, in fact, need a complemental index to restore the balance lost in the light of the other. In this way the two are put on planes of substantial equality, and the matter of choice between them becomes largely a question of predisposition. For the dictionary catalogue the key should be a tabular classification, showing the relations of allied topics, with an index of synonymous terms. For the classed catalogue the key should be an alphabetical list of topics, entered under every conceivable synonym.

There is a kind of indexing too seldom done in libraries, and yet it represents a present need, constantly emphasized. Live questions of the day, and literary questions brought into prominence by passing events, are matters that recur to students in their outside reading, and they constitute some of the more profitable subjects for themes and forensics. Articles and chapters bearing on such questions are usually buried in periodicals or books of miscellanea, sufficiently gone by to be not easily recalled. The librarian who has pursued a habit of indexing such articles as the numbers pass by, is always much better prepared for all such questions than he who lets the memoranda pass into dim corners of his unassisted memory.

I here leave the question of the relations which the college library should bear to the general conduct of the academic instruction, commending it to the serious attention of all whose lot has brought them to undergo the yoked labors of our colleges. The new interest that has of late been awakened in libraries as educational agencies does not, I feel sure, leave out of consideration that kind of library which seems so peculiarly fitted for sharing largely in the general appreciation. The college library, I trust, is starting on a new career.

ROCHESTER UNIVERSITY LIBRARY—ADMINISTRATION AND USE.

By Professor OTIS H. ROBINSON, *Librarian.*

In an institution of learning the transition from a small library to a large one is like the transition in a household from poverty to wealth: with new powers come new duties. It is fortunate in one case as in the other if with larger means there come also enlarged views, if new plans are devised which embrace the economical use of large and increasing resources. How to use a library is, therefore, a question of great and growing importance to nearly every college in the country. It is due to those liberal patrons of learning who are erecting library buildings and filling them with books that this question be carefully studied. It is due to officers of instruction that such a system be adopted that all the departments may increase symmetrically and be used in due proportion, without collision and without omission. It is due to students that with the use of larger libraries courses of study should be enlarged, and that special instruction should be given in methods of investigation. It is due to the public, in an age when libraries are exerting so great an intellectual and moral influence, that young men should come from the colleges thoroughly trained in their nature and their use.

There is evidence that a reform in this matter has already been begun. The old method, or rather lack of method, is passing away under the influence of the Library Association, the Library Journal, and the reports of the Commissioner of Education. The idea that a college librarian may serve the classes as an instructor quite as successfully as the professor of Latin or of mathematics is beginning to take root. It is beginning to be understood also that teachers can make an important use of the library in giving their regular instruction. In many places the libraries are becoming so large that careful attention must be given by readers to selection. The time has passed when a smart reader could exhaust the resources of the library on a given subject in a few weeks. Time is lacking now, not books. The question now is, what is up to date in science, vigorous in literature, and pertinent to one's wants—what on the whole is best? In answering this, teachers, as well as librarians, begin to see how great an influence for good may be exerted. The time is passing also when the chief duty of a librarian was to collect books and preserve them. How to get them used most extensively, most intelligently, and at the same time carefully, is becoming his chief concern.

The object of this paper is to describe clearly, yet briefly, the methods adopted in the Library of the University of Rochester, hoping thereby to contribute somewhat to the reform which we believe to be steadily

going on.[1] In doing this it will be proper to state the opinions which underlie our library administration, and some of the results of it which have become clear and definite. We wish to do this without pretension, claiming nothing except that we have given our attention to the subject. We have adopted some methods which we were not ourselves taught, and we think they have been successful. In some respects we are conscious that our library facilities are inferior to those of many other institutions, but we yield to none in the desire and the earnest effort to make the best use of what we have.

STATISTICS OF THE LIBRARY.

For convenience of reference we give at the outset the principal statistics of the library:

1. The library building is fire-proof and contains:

(*a*) A public room for the library, 112 feet long, 46 feet wide, and 22 feet high.

(*b*) A commodious room for art books and such others as require special care.

(*c*) A reading room.

(*d*) A librarian's private working room.

(*e*) A lecture room.[2]

2. The number of volumes is (December, 1879) 16,430.

3. Endowment for increase of the library, $25,000. (A definite promise has been made to double this fund.)[3]

4. Average yearly increase for the last three years, 1,325.

5. Reviews and magazines taken regularly, 29.

6. The classification is in 42 departments.

7. The officers are:

(*a*) A library committee for general management and purchase of books.

(*b*) A librarian (one of the professors of the university).

(*c*) One assistant librarian. (Other competent assistants are sometimes employed for special work.)

8. The library is open two and a half to three hours every day and two hours extra on Saturdays.

9. Everybody, without distinction, is invited to use the books at the building during library hours.

[1] If in some parts of this paper the writer has repeated, in another form, opinions already expressed by him in the Government report on libraries, it is because he could not otherwise perform well the task imposed upon him of describing our own library administration.

[2] Besides the rooms enumerated here, the building contains another of the same size as the large public library room and directly over it. This is to be used for our geological and mineralogical cabinets till the library is large enough to require it.

[3] Since the above was written this promise has been fulfilled.

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10. The readers who are allowed to borrow books to be used out of the library are:

(*a*) All officers, students, and resident graduates of the university.

(*b*) All officers and students of the Rochester Theological Seminary.[1]

(*c*) Resident clergymen.

Books are also sometimes lent, on special application, to other persons of known character and responsibility.

I.—PREPARATION OF THE LIBRARY.

Let us consider first the arrangements for making the use of the library easy and attractive. To those who have acquired the habit of reading and consulting, it will be attractive if easy; but very few of our readers come to us with such a habit. We are reminded every year by students about to leave that at first the library was to them little more than a blank; indeed, some of our best library workers have told us this. We are thus made to feel the importance of creating such an atmosphere in our library as shall attract those who, never having enjoyed the use of one, are not prepared to appreciate it. Whatever we fail to do, it is our purpose to make every student a reading man for life. The preparation of our library has this end constantly in view.

In the first place, all our cyclopædias and dictionaries, in fact all books that are used chiefly for reference, are kept in open cases in the central portion of the main room, always freely accessible to every one. There is no lack of room around them for work. As getting up and down is inconvenient while consulting large volumes, a long desk, to be used standing, is placed near these cases. Chairs, settees, and low tables are also at hand. Huge windows admit a flood of light over the whole. This is the students' working area. It is immediately under the eyes of the librarian and assistant at their desks, and yet there is absolutely no restraint except what is necessary for good order. It does not take long for the most inexperienced to begin to prize the free use every day of cases full of dictionaries and cyclopædias, including not only the general miscellaneous works of this class, but also those of history, biography, mechanics, chemistry, statistics, every thing, indeed, that is published with that methodical arrangement which fits it for reference.

Next after the works of reference comes the general catalogue of the library. This is on cards, complete always up to date, two or three cards for a book—authors, subjects, and titles mixed in one alphabetical arrangement like a dictionary. Classed catalogues are good for experienced readers, but for the student with little or no experience we believe every obstacle should be removed. We assume that he comes to the library with a knowledge of the alphabet and the Arabic numerals, and, requiring only these, try to put every thing within his reach. He has an opportunity to study classification at the cases, as will appear

[1] This is a courtesy extended by each institution to the other.

hereafter. By the use of numbers at one corner of the card, reference is made to the department and place of the book sought. These numbers are in the form of a fraction, the denominator denoting the department and the numerator the place in the department. A label on the back of the book contains the same fraction. The attention of every freshman class is called to a little printed card which hangs near the catalogue, containing directions in perhaps a hundred words for using the catalogue. When this has been done it very seldom happens that anything further has to be said. The work is so simple that it goes right on.[1]

The use of a catalogue suggests the importance of an index. All that class of books whose titles are so general that they do not suggest to an inexperienced reader the nature of their contents require an index. This is true not only of periodical literature, but of collections of essays on miscellaneous subjects, reports, and transactions of learned societies, &c.

While the cataloguing is going on a memorandum is made of every volume of this class in a book kept for the purpose. During each summer vacation the books so entered, together with the volumes of periodicals of the preceding year, are carefully indexed by subjects. The arrangement of the indexes is alphabetical.

Great care is taken to find out the word or words under which each article would be likely to be sought, the printed titles very commonly being ignored altogether. We have thus all of our periodical literature since the date of Poole's Index and nearly all our other books of a miscellaneous nature thoroughly indexed. The mode of keeping these indexes always in alphabetical order, up to date, and without supplements, is fully described in the Government report on libraries, and need not be given here.[2] We shall probably discontinue this manuscript index of periodical literature, as the Library Association has undertaken the work of making a printed one. But the index to miscellaneous literature, fortunately kept separate, has become an essential part of the growth of our library. It could not, either in its present or its prospective condition, be replaced by anything else.

There is no device which puts a student on the track of an investigation like these indexes. Very few subjects arise on which they do not contain something. And everybody knows how much of suggestion for further reading is often contained in a well written article which may be read in three hours. There is some advantage in keeping them just as we h ve done, so that they shall be exactly coextensive with the

[1] It may be remarked that after much careful study we have adopted, with some modifications, the system of classification known as the "combined system," devised by Mr. Schwartz, of the Apprentices' Library of New York. As much has been said and written on classification, and as Mr. Schwartz's plan has been pretty fully explained in the Library Journal, it need not be given here.

[2] Indexing periodical and miscellaneous literature, in Public Libraries in the United States, Washington, 1876, part I, page 663.

miscellaneous works in our own library, though the method is attended with much labor and expense. The printed indexes, in separate volumes, of the Atlantic Monthly, Harper's Magazine, and others, are seldom touched, while Poole's Index, for periodicals published before 1852, and our own, for everything else that we have, are in constant and most vigorous use.

Before leaving the subject of indexing it may be well to mention the mode of taking care of our pamphlets. We bind everything that we save, assuming that if a pamphlet is worth saving at all, a pile of them an inch and a half thick is worth a cheap binding. As they accumulate they are classified and numbered with the numbers of the general departments of the library, precisely like the books. They are then kept in a case prepared for the purpose, where the classes may be distributed in separate numbered boxes. When there are enough of them to do so advantageously the contents of the boxes are subclassified and volumes are made up under general titles. The more valuable of them are put into good bindings, and, when completed, are indexed like other volumes of miscellanies; those of less value are bound in the cheapest way. A table of contents, pasted on the cover inside, completes the volume in all cases where the pamphlets are not of a serial nature. We believe that pamphlets are quite as easily referred to in the library, and much less likely to be lost in the circulation, when thus classified, bound, and indexed, than when kept separate.

II.—PRIVILEGES ALLOWED STUDENTS.

When all these means have been provided—cyclopædias and dictionaries in abundance, catalogues and indexes in the most perfect order, and all the appointments of the library convenient and attractive—we have but opened the door and made the access easy. It remains to awaken and direct an interest in the books, for very few students will become regular and systematic readers merely from a sense of duty, whatever may be their facilities for finding the best reading when they want it. The trouble is, in many cases, that they do not want it. The want must first be created and then supplied. How is this to be done? We believe that it cannot be done well by shutting up the cases and requiring the student to stop with the cyclopædia, catalogue, and index and depend on an assistant librarian for the rest. This would be paving the road to the library, and forbidding any one to travel it. Education is best when it stimulates inquiry, gives it the right direction, and answers it. It is not idle curiosity which prompts a young man to take down books and turn them over. If he is a student, it is the curiosity which he ought to have and to indulge. There is danger in it. This no one will deny. We have often seen books worth fifty or a hundred dollars taken down from the shelves, turned over for half an hour, and put up again, with no more care than would be given to those which could be replaced for fifty cents. It has cost us a shudder. But then we have remem-

bered that those costly books were here to be used, and that the student was here to use them, and if it were not for his curiosity and his freedom to gratify it both these ends would very likely be defeated. And we have remembered also that that student may be one of the scholars of the next generation, and that he may be beginning here a life work among books, and that the whole course of a distinguished life may be determined by the opportunity given in those alcoves. If he fails to appreciate the rare old volumes, to understand their place in the history of science or literature, it is likely to be the fault of his teachers and his opportunities quite as much as his own.

And then we may have misjudged. Not unfrequently do we find, in our intercourse with students in the alcoves, that the best things in the library are known as such. The costly books are usually known, and the reason why they are costly. Indeed, in many respects, we find ourselves anticipated by students in the course of our instruction on the library and its uses. This is a kind of knowledge that propagates itself. Free, on certain days, to roam among the cases, the strong become the leaders of the weak. In the student society, as elsewhere, there is mutual dependence. A bright man whose early advantages have been superior, who is quick to see and ready to communicate, soon becomes a centre of influence. We have no fears for the tendency of such influence. Here the best opinions inevitably prevail. The library becomes a school of itself. What is taught by professors or found out by consultation is talked over with friends, and handed down from class to class, till there is a considerable body of facts and opinions which is the common property of all the readers. All the while the new men, inexperienced in libraries, are acquiring methods which will be of incalculable value for life. All this mutual assistance among the students themselves is a clear addition to that which is rendered by teachers.

Our library is thrown open in this way one day in the week. On Saturdays the students are all required to attend chapel and one lecture. At about ten these are over, and they have no further duties for the day. Then comes the time for the library. At least half the faculty and a large percentage of the students make it regularly a rendezvous. The best work of the week is often done here during the next three hours. Curiosity begets inquiry; inquiry leads to research. With note-book and pencil in hand, courses of reading and investigation are planned. These courses are based not wholly upon the opinions of others, but also upon personal examination of the books to be used. Statements of teachers or others, regarding books and authors, are compared with the books and authors themselves. Lists of books are made to be purchased by those who are soon to graduate and leave. And then the endless variety of themes for essays and orations and debates are all brought in at this time for personal investigation. Scarcely a Saturday passes but every department in the library is ransacked for its best material on many subjects. It is not claimed that

such investigation leads to the discovery of new truth; but, properly directed, it cannot fail to give the student much valuable knowledge of books, and, what is better, to develop a method without which no one can acquire broad scholarship. Add to this that a real interest is awakened in books as they appear in a library. In this age of libraries no course of education can be called complete which does not provide in some way for an exercise of the kind we have described.

III.—INSTRUCTIONS ON THE LIBRARY GIVEN IN THE CLASS ROOM.

So important do we regard a good library education, that special instruction is given on libraries and the method of using them. It is a common saying, and a true one, that next to the acquisition of knowledge itself is the learning where and how it may be acquired. The range of knowledge is rapidly increasing. New sciences are springing up and new and diverse applications of science are rapidly multiplying. And in every department of learning new outlooks are taken, giving rise to new forms of thought. All these demand a place in a curriculum of study. But the student period of a young man's life cannot be indefinitely increased. We believe, therefore, that the demand can be met best, not by making the curriculum cover everything, but by giving special attention to the *where* and the *how* of acquisition. A young man, diploma in hand, equipped with a good method, is far more likely to become a real scholar than one who has attempted a much wider range of study under instructors, but has not learned to instruct himself.

Attention is given to this subject by the faculty, both in the class room and in the library. The writer is accustomed, as librarian, to give familiar lectures from time to time to freshman and sophomore classes, to make them understand the great advantage of the use of a library, to explain in general terms the nature and use of the devices for finding what one wants, to show how they may supplement their course of study at every point by reading the authors and subjects studied, and, in general, to awaken as far as possible an interest in library work. Some facts are also given relative to the growth of libraries, especially in this country. These lectures or talks occur as opportunity offers, filling gaps when other professors are absent, or taking part of an hour now and then from his own regular class work. Professor Gilmore also, in connection with his lectures on English literature, gives special emphasis to the importance of becoming familiar with the library; and, besides, the mode of giving his instruction and the work he requires of students make such familiarity, in some departments at least, necessary, as will appear hereafter.

IV.—INSTRUCTION AND ASSISTANCE GIVEN IN THE LIBRARY.

But it is in the library itself that most of this kind of instruction is given. During the free hours on Saturday the professor of English, the professor of history, and the librarian are always present. President

Anderson and other members of the faculty spend more or less time there. The work there is face to face with the student. Professors come, not with a lecture prepared, but ready in a semi-official way to take up any subject which may be presented and show the inquirer how to chase it down. They understand well that they do this at some risk. It is one thing to appear always before classes on carefully studied subjects in one department of learning. It is quite another thing to go into a library for several hours every week where scores of students are at work, take off your professional gown, and offer yourself for assistance on everything that comes to you. Of course, each officer is likely to do most in his own special field. This division of the work is facilitated by the classification of the library, which is based, as far as practicable, on the division of the curriculum of study into departments usual in colleges.

We believe that this voluntary personal work does more to encourage broad scholarship and to make men independent in their investigations than any amount of class lecturing. First of all, it prevents the teacher himself from falling into ruts. No greater curse can come to an institution than the habit of repeating instruction unchanged year after year. In this work new fields of thought and action constantly demand attention. Old questions often come up in a new light and with fresh interest. Moreover, instruction so given is not given at random. The experience of a lifetime of study and reflection can here be brought to bear with peculiar emphasis upon those special needs which are felt and expressed. There is an opportunity to find out what has been read, and, starting with that, to show what may best be done and how. It is often expedient to take down the books for those who are inclined to ask questions but have not learned how to question a book, and open them at the chapters which should be read.

The intimate personal acquaintance and the natural influence of a teacher will enable him to do what a public librarian could not do. He may urge the use of good books where the tendency is to worthless ones. He may so direct the student that the freedom of the cases shall not lead to the dissipating habit of merely browsing among books, but to that of regular and systematic work. He may teach him how to take the measure of a book in an hour's examination so as to set it down in his note book for what it is worth. Sometimes a class lecture on the use of the library may be profitably followed up by taking a subject and showing how the various departments can be made to contribute to a thorough study of it. No description of this work can be complete, nor can the results of it be fully stated. It is sufficient to say, first, that those teachers who engage in it most heartily find themselves amply repaid by the increased interest taken in the work of their class rooms, and, secondly, that the students who are thus encouraged and assisted almost invariably become our best scholars while here, and after graduating look back to their work in the library as one of the most beneficial exercises of their college course.

While on this subject it may not be impertinent to suggest that possibly the new demand which we often hear for library professorships can be met best, in all but the largest institutions, by a plan in some respects similar to what we have described. Let it be somewhat more complete and systematic, but not compulsory. Every officer of instruction knows his own department better than the most learned librarian could be expected to know it. Let every one have a regular hour, one that shall be convenient for students, when he can be found in the library to encourage, direct, and assist all who are reading or making special references in his department. Let the official relation of the professor be replaced for the time, as far as possible, by that of a literary or scientific friend, and the interviews, thus made pleasant and profitable, will soon become attractive. The work could thus be well done which now, we suspect, many a librarian, from no fault of his own, is doing but poorly. The labor for each would not be great; the results, if we may judge from our experience, would be most beneficial.

V.—USE OF THE LIBRARY BY PROFESSORS IN GIVING THEIR REGULAR INSTRUCTION.

From all that has been said it will be evident that the use of our library influences very largely the character of the instruction given in the class rooms throughout the university. Our library is to us all what a laboratory is to a teacher of physics or a cabinet to a teacher of geology. The narrowest view of education that can be taken is that of mere text book learning. But from a good text book as standing ground, an outlook may be taken as broad as may be desired. It is customary, we believe, to accomplish this by means of supplementary lectures by professors. This is our custom in part; but we have for several years added to it, and that we think successfully, an outlook by the students themselves through the use of the library. The system so involves the administration of the library that it should be given here.

In nearly every department, in addition to the text studied and to the professor's lectures, oral dissertations are required on subjects assigned. These are not usually written, but carefully prepared and delivered to the class from notes. The subjects are assigned by the professor early in the term; they are made so that, all together, they shall cover the principal points, historical, biographical, &c., suggested by the term's work. References to books are given with the subjects. When the term is well advanced the dissertations are given from time to time, as is found convenient. The student assumes for the time the functions of the teacher. No exercises are prepared with greater care and no instruction receives better attention from the classes than this which is given by the members themselves. The professor is present to correct or to supplement wherever he sees the need of it.

These dissertations have in general nothing to do with the work of English composition as taught by the professor of rhetoric and English.

And still it is in this department that they probably have their highest value. The nature of the subjects assigned, the reading done in investigation, and the presentation to the class, all have a direct and manifest bearing on the work of that department. For this reason Professor Gilmore has made a specialty of this exercise. He keeps in the library for the use of students a book of subjects, with references, from which selections are made for these dissertations. The references are constantly undergoing revision as the library increases. He keeps also in the library an extensive printed list of themes, with references, from which students may make their own selections as essays are required. In connection with these themes he gives explicit printed directions for finding material in the library, and says, in addition: "The professor of rhetoric will be in the library every Saturday morning to assist students in finding material for essays, dissertations, &c." Other professors find it expedient to follow their classes to the library for the same purpose.

We give as specimens a few subjects which have been used, taken from several of the departments. It will be seen that the whole scheme requires a vast amount of work in the library. It cannot fail to be noticed also that thirty or forty of these subjects, carefully prepared and presented to a class during a term's work in any department, must enlarge the view and broaden the scholarship immeasurably, as compared with mere text book work. And while doing this a method is acquired which is worth more than all the rest.

1. History of the use of the term "idea."
2. Influence of Cartesianism on English thought.
3. Savings banks, their history and safeguards.
4. The place of Adam Smith in political economy.
5. History and uses of bills of exchange.
6. Carbon, native forms and compounds; uses in the arts; functions in animals and plants.
7. Sugar, principal kinds; sketch of the history of beet root sugar.
8. Bread, manufacture, kinds, adulterations.
9. The Puritan literature of Britain.
10. The great English orators.
11. English translations of Homer.
12. The invention of logarithms and the origin of logarithmic tables.
13. The methods of Galileo and Descartes in physical science compared.
14. Newton's experiments in light, and his explanations of the phenomena of light on the emission theory.
15. The commerce of the Phœnicians.
16. Description of the pyramids of Egypt.
17. The organization of the Persian Empire under Darius the Great.

VI.—EXTRA CURRICULUM WORK GROWING OUT OF THE USE OF THE LIBRARY.

Besides the extension of the course growing out of these class room dissertations, we encourage and provide for a large amount of extra curriculum work which depends almost wholly upon the use of the library. There are, we believe, in every institution two classes of students, the

text book men and the reading men. Lack of natural ability, sickness, poverty, and disinclination to study limit many to the mere work of learning lessons assigned. An easy subject may be prepared now and then for presentation in the class room, but their ability or their ambition does not extend beyond this. They pass examinations from year to year, and receive their bachelor's degree, with no special marks of distinction. It often happens, however, in after life, when the disabilities are removed, that these men acquire a scholarship beyond the promise of their college days. The other class, more fortunate and more ambitious, the reading men, are always looking for more work. This demand might be met by extra text books and lectures, but this method, besides imposing an additional burden on teachers, would fail to develop the very powers which these men are likely to possess. We have chosen, because better for the students themselves, to give them subjects for investigation requiring wide and careful reading.

These subjects form a clear addition to our course. They constitute a variable element, which adapts itself to the ever changing demands of the times and tastes of the students.

We select and present as specimens a few of the subjects which our students have studied during the last two or three years. No mention is made here, however, of the extra curriculum work done in classical and mathematical reading, for which they can easily provide their own books, as this has no special relation to the library.

1. The place of Edmund Burke in literature and politics.
2. The political character and aims of Julius Cæsar.
3. The political characteristics of the Greek colonial system.
4. The ethical and economical bearings of modern socialism.
5. The national school of political economy in Germany.
6. The spread of the Greek language and literature through the conquests of Alexander.
7. The educational system of Rome during the classical period.
8. The causes of obscurity in Tennyson's poetry.
9. The theory and uses of the pendulum.
10. The principles involved in the construction of the telescope and its uses in astronomical investigation.

On subjects like these about one-fourth of our students are always engaged. A college year is spent on a subject. The library is, of course, the principal source of information, and that it may be well supplied for this work purchases are made every year with special reference to the subjects announced for the year. The assistance given by professors to the students in the library tends to save students from wasting time by reading at a disadvantage. The excellence of their work is tested by requiring either written answers to questions set by the faculty or general written dissertations on the subjects. By this system we believe it is practicable, with suitable attention on the part of the officers of instruction, to preserve the time honored curriculum of disciplinary study substantially intact and at the same time to meet the modern demand for a greater range and variety of elective studies.

VII.—POST GRADUATE STUDIES ENCOURAGED.

By proper administration a college library may prolong its usefulness to students after the regular course of study is finished. We believe there is truth in the saying that "the library is the best university;" but the university course implied by this saying should follow the ordinary college course of America. It is our aim to fit men to pursue such a course independently and successfully. Having acquired such library habits as we have described very few young men will lay them aside on graduating. We give to our alumni the same library privileges as to students, and the number of post graduate readers is constantly increasing. We have but two regular post graduate courses endowed. These are of such a nature that they are not likely ever to be taken except by men of reading habits. For them the library is a constant resource. Many others who become teachers, or who pursue professional studies in the vicinity, continue their investigations in the alcoves of our library almost as regularly as when they were students.

VIII.—DANGERS TO BE AVOIDED.

There are some tendencies in the use of a library, as we have described it, which cannot be commended. First of all, there is danger that some will make it merely a place to find answers to questions or to study particular questions previously determined upon. Doubtless a library should be used in this way very largely, but it may be overdone. There are books which should be read through leisurely as a whole, not for the sake of finding out what they say on some narrow question, but for the sake of the books themselves. Some may be read in this way several times with profit. Courses of reading should be pursued where one brings to the best authors regularly at his leisure hour a mind free to receive an impression from their learning and their style. The minds of the young will be enlarged by such contact with the masters in literature and science as they could not be by merely running over books for a chapter here and an article there on the subject they are at work on. We do not say that this is incompatible with our library management, but it must be admitted that there is a slight tendency, in the rush of work on subjects, to neglect this kind of reading. Culture demands that it should not be neglected, and the professors, as well as the librarian, should keep it steadily in view.

Another tendency which has to be guarded against is that of indifference to the pecuniary value of books. We believe in using our books, and not in shutting them up, though we are well aware that young persons who are allowed to use freely what costs them nothing are likely to use it without sufficient care. Of course, this is a matter which can be met only by constant watchfulness. It should be said, however, to the credit of our students, that during the thirteen years that they have had the freedom of the cases every week we have hardly lost books

enough to be worth mentioning, and the handling of those used has seldom been censurable. We have trusted them freely, appealing to their honor, and we have not appealed in vain.

We may add, as another possible evil, that there will always be students who will be ready to justify a neglect of the regular work of the course for the sake of reading. It seldom happens, however, that such students are regular and systematic readers. They are usually vagabonds in the library as well as in the classes. No library administration would give them fixed purposes and steady habits. If the officers of instruction are able in any way to turn their willingness to read to good account, it may be the best thing that can be done for them.

We recognize these as apparent objections, or dangers, in a system which gives so great freedom in the library and requires so constant use of it in the study of subjects. We know of no case, however, where they have led to serious evils. With the eyes of nearly all the faculty continually on the work done in the library it is not easy for an evil tendency there to escape observation.

CIRCULARS OF INFORMATION

OF THE

BUREAU OF EDUCATION.

No. 2—1880.

PROCEEDINGS OF THE DEPARTMENT OF SUPERINTENDENCE OF THE NATIONAL EDUCATION ASSOCIATION, AT ITS MEETING AT WASHINGTON, D. C., FEBRUARY 18-20, 1880.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1880.

29-30

CONTENTS.

LETTER.

DEPARTMENT OF THE INTERIOR,
BUREAU OF EDUCATION,
Washington, June 30, 1880.

SIR: The chief educational officials of our State and municipal public school systems form a separate department of the National Education Association, and meet for consultation and the discussion of subjects of interest to the profession and the public. The proceedings at the meeting in the month of February, 1880, were important. Among the principal papers on subjects discussed were Bell's visible speech as a means of recording and teaching languages and the deaf-mute, the tenth census from an educational point of view, industrial education, the treatment of dependent children by the State, the best public school system for a State, higher education, and the educational needs of the Southern States.

These papers and discussions are on living topics, will answer many demands upon this Office, and will prove useful to educators and school officials generally. I therefore recommend their publication as a circular of information.

I have the honor to be, very respectfully, your obedient servant,

JOHN EATON,
Commissioner.

Hon. CARL SCHURZ,
Secretary of the Interior.

Approved, and publication ordered.

C. SCHURZ,
Secretary.

NATIONAL EDUCATION ASSOCIATION.

DEPARTMENT OF SUPERINTENDENCE.

MEMBERS PRESENT.

Hon. M. A. Newell, State superintendent of public instruction, Maryland.

Hon. J. W. Dickinson, secretary of State board of education, Massachusetts.

Hon. E. A. Hubbard, agent of State board of education, Massachusetts.

Hon. J. P. Wickersham, State superintendent of public instruction, Pennsylvania.

Hon. W. A. Lindsey, deputy State superintendent of public instruction, Pennsylvania.

Hon. J. H. Smart, State superintendent of public instruction, Indiana.

Hon. James P. Slade, State superintendent of public instruction, Illinois.

Hon. G. J. Orr, State school commissioner, Georgia.

Hon. W. H. Ruffner, State superintendent of public instruction, Virginia.

Hon. T. B. Stockwell, State commissioner of public schools, Rhode Island.

Hon. J. W. Hoyte, member of State board of education representing the State superintendent of public schools, Tennessee.

Hon. W. K. Pendleton, State superintendent of free schools, West Virginia.

Hon. J. D. Pickett, State superintendent of public instruction, Kentucky.

Hon. J. Ormond Wilson, superintendent of city schools, Washington, D. C.

Hon. W. T. Harris, superintendent of city schools, St. Louis, Mo.

Hon. Aaron Gove, superintendent of city schools, Denver, Colo.

Hon. A. P. Marble, superintendent of city schools, Worcester, Mass.

Hon. George J. Luckey, superintendent of city schools, Pittsburgh, Pa.

Hon. H. S. Tarbell, superintendent of city schools, Indianapolis, Ind.

Hon. John C. Hervey, superintendent of city schools, Wheeling, W. Va.

Hon. I. L. Irwin, superintendent of city schools, Fort Wayne, Ind.

Hon. J. A. Nichols, superintendent of city schools, Yonkers, N. Y.

Hon. R. McMillan, superintendent of city schools, Youngstown, Ohio.
Hon. Hamilton McRae, superintendent of city schools, Muncie, Ind.
Hon. Henry Shepherd, superintendent of city schools, Baltimore, Md.
Hon. S. A. Baer, superintendent of Berks County schools, Pennsylvania.
Hon. Richard Carne, superintendent of city schools, Alexandria, Va.
Hon. J. A. M. Passmore, president of board of education, Pottsville, Pa.
Dr. D. B. Hagar, principal of normal school, Salem, Mass.
Prof. I. N. Carleton, principal of normal school, New Britain, Conn.
General S. C. Armstrong, principal of normal school, Hampton, Va.
Prof. George P. Beard, principal of normal school, California, Pa.
Miss Lucilla E. Smith, principal of normal school, Washington, D. C.
Mrs. Louise Pollock, principal of National Kindergarten Institute, Washington, D. C.
Hon. John Eaton, United States Commissioner of Education, Washington, D. C.
Hon. John D. Philbrick, United States commissioner of education, Paris Exposition, Boston, Mass.
Dr. Barnas Sears,[1] general agent Peabody education fund, Staunton, Va.
Hon. F. A. Walker, Superintendent United States Census, Washington, D. C.
Dr. D. C. Gilman, president Johns Hopkins University, Baltimore, Md.
Dr. Charles Warren, chief clerk Bureau of Education, Washington, D. C.
Hon. T. W. Bicknell, editor New England Journal of Education, Boston, Mass.
General C. E. Hovey, lawyer, Washington, D. C.
Prof. L. A. Butterfield, School of Vocal Culture, Boston, Mass.
Mrs. L. A. Butterfield, School of Vocal Culture, Boston, Mass.
Prof. Alexander Graham Bell, inventor of Bell telephone.
Prof. C. C. Painter, Fisk University, Nashville, Tenn.
Prof. J. M. Wilson, trustee Industrial Home School, Washington, D. C.
Prof. Z. Richards, principal Eclectic Academy, Washington, D. C.
B. G. Lovejoy, esq., member board of education, Washington, D. C.
A. Hart, esq., ex-member board of education, Washington, D. C.
J. W. Schermerhorn, New York City.
Prof. Theodore Fisk, University, of Nashville, Tenn.
Hon. Josiah Dent, president board of commissioners District of Columbia, Washington, D. C.
Hon. C. M. Mathews, president board of education, D. C.
Mr. Edward Baldwin, member board of education, D. C.
Dr. Arthur Christie, member board of education, D. C.
Prof. J. Enthoffer, United States Coast Survey, Washington, D. C.

[1] Since deceased.

Mr. J. R. Bigelow, Washington, D. C.
Mr. J. L. Smith, Washington, D. C.
Miss Gertie Cowling, instructor primary class, Washington, D. C.
Aaron Smith, Brooklyn, N. Y.
William T. Schofield, Philadelphia, Pa.
Dr. F. B. Hough, Lowville, N. Y.
Rev. W. W. Patton, president Howard University, Washington, D. C.
L. P. Juvet, inventor of the time globe, Glen's Falls, N. Y.
Rev. Russell A. Olin, Canajoharie, N. Y.

PRELIMINARY MEETING.

The department met in the red parlor of the Ebbitt House, Wednesday evening, February 18, 1880, President Newell in the chair, and Hon. Aaron Gove, of Colorado, secretary.

The programme as originally announced in the printed circular was informally talked over.

General EATON said that Hon. C. D. Randall, of Michigan, could not be present, but had forwarded his paper on "The education of children who are neglected by their parents," and he would lay it before the department at the proper time.

President NEWELL said that Superintendent Parker, of the Quincy (Mass.) schools, would not be present.

General HOVEY inquired whether, in the absence of Mr. Parker, the subject of the "new departure" at Quincy would come up for consideration? This query led to some discussion between Messrs. Hagar, Hovey, Richards, Luckey, Marble, Dickinson, and others, who expressed much satisfaction that the Quincy people had gone to work to improve their common schools. There was some doubt expressed, however, whether what is heralded as a "new departure" was other than a "new departure" for Quincy; in fact, its best features, so far as they had been disclosed, were quite old—as old as Pestalozzi in Europe and "Father Pierce" in America. They had long been familiar to the profession, and were in practical operation in the schools of many towns and cities. It was decided, however, not to consider the question in the absence of Mr. Parker.

The remainder of the programme was unchanged.

FIRST SESSION—THURSDAY MORNING.

WASHINGTON, D. C., *February* 19, 1880.

The department met at 10 o'clock A. M. in the vestry room of the Congregational Church, corner of Tenth and G streets, and was called to order by the president, Hon. M. A. Newell, of Maryland.

Rev. Dr. C. C. MEADOR offered prayer.

Hon. S. A. BAER, of Pennsylvania, was appointed secretary.

Hon. J. ORMOND WILSON, of the District of Columbia, moved the ap-

pointment of committees, extended an invitation to the department to visit the city schools, and stated that a bill was now pending in Congress to incorporate the "National Education Association."

The chair announced the committees as follows: *Executive committee*—Messrs. Wilson of Washington, Harris of St. Louis, Slade of Illinois. *On invitations*—Messrs. Hovey of District of Columbia, Bicknell of Massachusetts, Gove of Colorado. *On national legislation* (with power to add to their number)—Messrs. Ruffner of Virginia, Orr of Georgia, Smart of Indiana, Dickinson of Massachusetts, and Wickersham of Pennsylvania. *On resolutions*—Messrs. Hagar of Massachusetts, Tarbell of Michigan, and Luckey of Pennsylvania.

The president then introduced Prof. L. A. BUTTERFIELD, of Boston, Mass., who made the following address:

VISIBLE SPEECH.

The science of visible speech embraces a knowledge of the elementary sounds of all languages and a set of physiological characters representing those sounds. The principles and natural laws of the vowel and consonant formations were discovered in the year 1864 by Prof. Alex. Melville Bell, of the Edinburgh University, after many years of careful study and investigation. When he had wrought out and clearly defined the principles of his discovery, he devised a convenient set of characters or symbols to represent the individual sounds of all languages. All articulation depends upon the parts of organs used in speech, and the relation of these parts to one another.

Mr. Bell discovered the universal phonetic basis of language by a careful and experimental study of all the organs used in articulation, and all the positions and relations in which they are adjusted in the production of speech. He gave to each organ used in articulation a distinct symbol, pictorial of the part used; also the relation of the organs to each other he symbolized in a similar manner: so that each symbol in the alphabet indicates to the eye what organs are used and the definite positions in which these organs are placed in the production of any element of speech.

There are two sets of organs used in articulation, the upper and passive set, consisting of upper lip, upper gum, hard palate, soft palate, &c., the lower and active set of organs, consisting of lower lip, point of tongue, top of tongue, back of tongue, &c., which are brought near or against the upper set in the act of articulation.

Each vowel or consonant sound depends for its individual quality or character upon the definite position or action of the organs of speech. Knowing the position of the organs for any element in any language, and adjusting the organs for that position, one can produce only the element desired, and the visible speech character in the universal alphabet expresses to any one acquainted with the system the particular and definite position for that element. The visible speech symbol used to

represent the English P indicates that the lower lip is shut against the upper lip, and that this position is immediately relaxed with an expulsive puff of breath. The symbol for B indicates the same position of the lips as for P, with a slight vibration of the vocal chords. For M the lips are closed as for P and B, with voice escaping through the nasal passage. For T the point of the tongue is raised against the upper gum (entirely closing the mouth passage) and immediately relaxed, with an expulsive puff of breath. For D the same position of the tongue is taken as for T, with slight vibration of vocal chords; for N the same position as for T and D, while voice escapes through the nasal passage. For K the back of the tongue is closed against the soft palate, and immediately relaxed with a puff of breath. For the sound of G as heard in the word "go," the back of the tongue is in the same position as for K, with a slight sound from the larynx. For the sound we call *ng* as in the word "morning," the back of the tongue is closed against the soft palate as for K and G, with voice escaping through the nasal passage while the position is held. For L the point of the tongue touches the upper gum in the centre, but does not entirely close the mouth passage, the voice escaping on each side of the tongue. For Y the central part called top, of the tongue is raised near the hard palate, leaving a very small passage through which the vocal current passes. In like manner is the mechanism of all languages and all dialects indicated. In the visible speech alphabet are symbols to represent all the sounds of all languages, and any one understanding the principles of the system can articulate all these sounds by simply executing with the organs of speech whatever the symbols dictate.

Soon after Professor Bell perfected the system of visible speech, it was carefully tested by scientific and literary men from the principal European nations and by commissioners from other parts of the world. Mr. Bell had no difficulty in representing by his alphabet any sounds in any language.

SOME OF THE APPLICATIONS OF VISIBLE SPEECH.

Foreign languages.—Much time is spent and often great difficulty experienced by students of modern languages in gaining sufficient mastery of their pronunciation to enable them to use these languages as a means of communication. It is a very easy matter for apt students to learn to read the French, German, Spanish, Italian, and other languages, but it is quite another thing to speak these languages with correct sounds and native accent. It is very common that American students and even teachers of French and German in our colleges and seminaries find it difficult and often impossible to make themselves understood in speaking those languages in France and Germany. The difficulty is simply that they have learned to read these languages in the elementary sounds of the English language, some of which are as unlike some of the French and German sounds as are the Roman letters unlike the

Greek or German text. A knowledge of visible speech enables one in a very short space of time to gain easy command of any of these new sounds. The facility with which one may gain pronunciation of new sounds in any language is apparent to any one who has witnessed the demonstrations which Professor Bell and myself have often made in the presence of large numbers of teachers and educators.

At the Massachusetts State Teachers' Association, held at Worcester, January 4, 1879, the following test was made: One of my pupils, Mr. J. H. Brown, a gentleman from Canada who had studied the system with me for five weeks only, went into an adjoining room while the audience dictated French, Greek, Japanese, and German words which I wrote on the blackboard in visible speech symbols. Mr. Brown was called, and he articulated what was upon the board with perfect accuracy. At a lecture before the Packer Collegiate Institute, Brooklyn, N. Y., February, 1879, Mrs. Butterfield and some of the young ladies of the college retired from the audience room while other students and teachers translated English sentences into French and German, pronouncing them in very good French and German sounds. I wrote their pronunciation upon the blackboard. Mrs. Butterfield and the young ladies were called. Mrs. Butterfield read the sentences upon the board just as originally pronounced; the young ladies understood them in French and German, and gave us the original meaning in English. I have made similar tests of the system before large audiences of educators in over twenty languages and dialects, and always with perfect results. Any student of modern languages will find it a very easy matter to acquire the ready pronunciation and command of the sounds of those languages by a knowledge of this system.

Standard of pronunciation.—The visible speech alphabet furnishes the means of fixing and preserving a standard of pronunciation in all languages. If such a phonetic standard had been known to the Greeks and Romans, the pronunciation of the ancient orators could have been definitely and absolutely preserved.

Mr. Shuje Isawa, from Tokio, Japan, and Mr. Tanetaro Megata, Japanese commissioner of education to the United States, studied this system with me at the Boston School of Vocal Physiology. Mr. Isawa is now principal of the Tokio Normal School in Japan, and Mr. Megata has recently returned to his native land. These two gentlemen propose to unify the pronunciation of Japan, and bring the many dialects of that country to a common standard. Professor Luther Whiting Mason, who has recently been engaged by the Japanese Government to introduce music in the schools of Japan, and who has studied the system to some extent, says, to quote his own words: "I shall make visible speech the basis of all my work in Japan."

Primary instruction.—By the use of this system, the children in our schools may easily be taught the proper pronunciation of all the elementary sounds in the language. It would not increase the labor of

pupil and teacher, but would greatly simplify the work now attempted. If the primary school teachers were thoroughly furnished with a knowledge of the system, it would undoubtedly be economy in the plan of a thorough education. In the United States, children from foreign countries could readily be taught to speak English with the same sounds and accent as American children speak it. If visible speech were a part of the regular course of study in our normal and training schools, it would greatly increase the usefulness of our teachers and revolutionize the pronunciation of our public schools, obtaining an easy and elegant pronunciation where now may be found imperfect articulation and drawling sounds.

Defects of speech.—If the mechanism of speech was thoroughly understood, the primary and grammar school teachers might easily remove lisping and similar defects of speech from children under their care. The tendency to develop one articulate position for another might readily be corrected by showing the child what is at fault and pointing out the positions the articulating organs should assume to produce the elements desired.

Christian missions.—Visible speech will be of great value in mission fields. The difficulties which missionaries have experienced in acquiring the pronunciation of the natives of any country and in teaching the natives the pronunciation of their languages will readily disappear by the use of this system. Visible speech has already been introduced into China by a missionary from Scotland. Large portions of the New Testament have been translated into the Chinese spoken language and printed in visible speech symbols. The Chinese written language and the Chinese spoken language are two distinct languages. The Chinese spoken language was never written or printed until visible speech was employed for that purpose. The value of visible speech to mission work will be apparent in the following demonstrations, which were made in Boston, Mass., December 26, 1879: Rev. Mr. Richardson, who has been a missionary in Turkey for many years, gave difficult sentences in Turkish and Armenian dialects, which I wrote upon the blackboard in visible speech symbols. Mrs. Richardson gave the Arabic words of "Our Father, who art in heaven," which were also written upon the board. A pupil and a little daughter of the missionary, who had been sent out of the room while the sentences were given, came in. The pupil articulated correctly what was upon the board, and the little girl translated it. Rev. Mr. Richardson said that he had never before met a person who could pronounce for the first time correctly a very difficult word that he gave in the Arabic language.

I recently gave demonstrations at the Newton (Mass.) Theological Institution. Mrs. Butterfield retired from the lecture room while sentences in various languages were given. Mr. Thomas, a young student in the theological school, who was born in Burmah and spoke the Karen dialect, gave sentences in his native tongue, which were written upon

the blackboard in the phonetic symbols. Mrs. Butterfield came in and read with perfect accuracy the sentences upon the board. Mr. Thomas pronounced her articulation of the Karen sentences correct. He said his father could not pronounce them with such vernacular accuracy after having lived in Karen eighteen years.

SIMPLICITY OF THE SYSTEM.

The system of visible speech may readily be acquired by any one. A practical teacher may learn the system thoroughly in from three to six weeks by devoting a little time to the subject each day. By directing the attention to the mechanism of the elementary sounds, these definite sounds may be taught as object lessons to the eye. In this way any child may acquire the pronunciation of all the sounds of the universal alphabet with surprising ease and rapidity. The system was introduced into Boston, Mass., in the year 1871 by Prof. Alexander Graham Bell, the inventor of the Bell telephone and son of Alexander Melville Bell. Professor Bell has applied the system to the teaching of deaf-mutes in the United States with great practical resuls. The number of characters used to represent all the sounds of all languages may not exceed one hundred. Visible speech does not interfere with any existing alphabet; it does not make a standard in any language, but furnishes the means of representing and preserving any standard of pronunciation which may be established.

Professor Butterfield illustrated his lecture by blackboard exercises. He drew a diagram of the organs of speech and clearly demonstrated the principles of the system.

The following test was given: Mrs. Butterfield, who understands the system, was requested to retire from the room while sentences were given in foreign languages. Sounds in Hindoostanee were given by Dr. Warren, of the Bureau of Education; sentences in Russian and Bohemian were given by J. Enthoffer, United States Coast Survey; and an illustration in Gaelic was given by Dr. Newell, president of the association; all of which were written by the speaker upon the blackboard in visible speech symbols. Mrs. Butterfield returned to the room and pronounced with accuracy the sentences upon the board.

In the discussion that followed,

President NEWELL asked if the following out of this method did not depend entirely upon a correct ear and a cultivated voice.

Professor BUTTERFIELD called on Prof. Alexander Graham Bell, the inventor of the telephone and son of the inventor of this alphabet, to inform the audience as to what his experience had been in this particular.

Professor BELL said he thought he could prove that the ear was an entirely unnecessary organ. He, himself, had been very successful in teaching deaf-mutes by these characters, and of course without the aid of the ear at all. The ear was really very often a defective organ, and

may frequently be accustomed to understand defective sounds. The sounds taught by this method are necessarily correct. He would go further and say that speech may be acquired when the ear is entirely wanting; and gave as an instance the case of two children that came to his notice, who entirely lost their hearing from scarlet fever and were fast losing their power of speech. As a last resort their teacher was induced to adopt this method, which showed astonishing results. They learned quickly, and by having words printed with these characters underneath they soon taught themselves to read.

Dr. HARRIS said that one of the most important books in his library was upon this subject, and it was one that he was in the habit of frequently consulting. He supposed physical training necessary for the successful use of this method.

A member inquired whether the sounds that these characters represent would remain the same although the pronunciation of the words of a language was constantly changing.

Professor BELL thought that the gentleman misapprehended the value of the alphabet and the purposes of its users. If the standard pronunciation of a word at any given time can be recorded in this absolutely phonetic and physiological alphabet, every subsequent change in its pronunciation can be recorded as easily. A record of this kind, showing the actual variations of typical spoken words in our own language since the time of Chaucer, or even of the Elizabethan period, would be of inestimable value to philologists. The use of the alphabet in education to indicate the present accepted pronunciation of words is another valuable but quite different one, and should not be confused with its use for historical linguistics.

NATIONAL COUNCIL OF EDUCATION.

Mr. BICKNELL, of Massachusetts, read a paper "proposing a plan for a national council of education." The paper has not been furnished for publication, nor can an abstract of it now be made; in the expectation that the paper itself would be available, no notes were taken at the time. It may be said generally, however, that the writer defined and explained what he understood by a national council of education, and suggested reasons for its establishment. He did not go much into details, nor commit himself as to the number or qualifications of members; how they should be chosen, by whom, or for how long; whether they should be paid for their services, and, if so, how much or by whom; or whether their acts should be regarded as advisory or mandatory; or what should be the exact scope of their powers and duties. But he argued in a general way in favor of establishing some national authority to which the great body of educators might appeal as a court of last resort—a body competent to formulate principles and courses of study, and to give safe counsel.

The paper closed with a resolution intended to draw out an expression

of opinion from the department as to the advisability of constituting such a council.

Mr. TARBELL, of Indiana, moved as an amendment that the department of superintendence be charged with the duties of the proposed council.

Dr. HARRIS opened the discussion of this paper. He thought that an educational council, such as was proposed, could be easily organized under a central government like the governments of Europe, but not here, especially if it was proposed to invest it with any conclusive power. Our separate communities are jealous of any centralization of authority. Again, if the council was to be representative of public or state education, it would necessarily be composed of superintendents, and that would give us our present department over again. The plan, however, contemplates long sessions and deliberate consideration and action. But superintendents are engaged in exacting positions, requiring all their time and attention to protect systems and interests for which they are in some sense responsible. They can hardly be spared to enter the domain of the scholar or philosopher, or to be absent sufficiently long from their special field of labor.

A backhanded blow may be given through the city council or the State legislature when least expected, or may lurk under a bill or resolution most innocent on its face. He, however, desired to be understood as suggesting difficulties rather than expressing opinions.

President NEWELL here informed the association that the time was so limited that he should be obliged hereafter to limit the debate to five-minute speeches.

Mr. WICKERSHAM, of Pennsylvania, said that matters of great weight and vital interest would always be before such a body as the proposed council for consideration and action, and such consideration and action would involve close and scientific investigation, and a good deal of it. But of what value would all this be if there was no authority to enforce the conclusions and acts of the council? It may be that the moral or advisory power of the opinions of such a body might give to their acts the necessary authority, and in that case no one could object to it, not even Mr. Harris himself. To touch on another point, the scheme of a council, as suggested in the paper just read, seems to contemplate a somewhat large membership, whereas he thought a small body would be better. A large council would simply be the national association over again.

Mr. HARRIS, of St. Louis, remarked that if this council could be organized to treat subjects scientifically and publish the results it reached, as wholly advisory, it would be a welcome organ. But this matter should come up now only for discussion; there should be no immediate action; we should make haste slowly.

Mr. SHEPHERD, of Baltimore, agreed with Messrs. Harris and Wickersham, yet he could not see why an organization of this kind could not

be effected for the discussion of subjects that might come before it scientifically, in a proper manner, instead of in the "ad captandum" way usual in our popular assemblies.

Mr. MARBLE, of Massachusetts, said that the superintendent of St. Louis had fully demonstrated the possibility of a superintendent at once a scholar and a philosopher. If some organization could be effected by which the rich experience and valuable ideas of eminent educators could be made available by publication or otherwise to their co-workers, it would be exactly what was needed. It is a matter of public history that the most intelligent school labor is constantly being neutralized or thwarted by ill considered publications and criticism; and this condition of things was rendered possible, he thought, because we have no standard or authority in such matters. There is no authoritative controlling educational influence in this country whose matured conclusions can be offset against the flippant assertions of any upstart who can publish his *opinions* upon this or that subject in the newspapers, which are immediately quoted as reliable. Of course they are only opinions, but then they have their influence.

Dr. HAGAR, of Massachusetts, advocated the formation of a national council, something after the plan suggested, as a means of establishing correct opinions on educational questions and of combating and overthrowing heresies and false notions of education. Of course it must be so constituted as to command the confidence and respect of the great body of teachers, but it is not necessary that it should be a large body.

Dr. HOYTE, of Tennessee, thought there would be great difficulty in agreeing upon the limits of eligibility to the office of councillor; that is, in determining who might, and who might not, be eligible to a seat in that body, and, if an agreement could be reached on that point, then what power should elect or appoint these councillors? Upon both these vital questions he thought the paper just read was too general in its terms or suggestions. Something specific and in detail ought to be proposed, if practical results are contemplated. Then, again, who shall determine the length and frequency of the sessions of this council? What are to be the expenses and how are they to be paid?

He would remind them of one serious difficulty that they must guard against, which usually threatened educational associations. If great care was not taken the omnipresent book agent would worm himself in and monopolize the whole thing and be the controlling power.

Mr. GOVE, of Colorado, seemed to see almost insurmountable obstacles to such an organization. It would seem easy enough for the members of this department to suggest fifty names for membership in such a council, and their participation would be an earnest of the usefulness and influence of the organization; but such a beginning would in some measure thwart the ultimate purpose by offering suggestions of exclusiveness. As an attachment, adjunct, or branch of the National Educa-

tion Association, he did not see, with the little thought he had given the matter, how the desired and necessary material was to be obtained.

The several departments are not relatively of the same importance to the practical work of education. He was of the opinion that an annual meeting for the ends indicated in the paper, and with which effort he was in hearty accord, could be best obtained by voluntary attendance; that if six or more gentlemen, eminent in the profession, would issue an invitation for such a council, stating in such invitation in as detailed a manner as possible the exact object, limitations of discussions, &c., the persons who would respond would be just those whose presence would be most desired, while those not vitally interested would scarcely put themselves to the trouble and expense of attendance. In this whole matter, however, it would seem that further and broader counsel should be sought. It is too important a measure to be hurriedly settled. He trusted the department would cause it to be properly referred for further consideration and report.

Mr. SMART, of Indiana, said there could be no objection, in his opinion, to such an educational body as the proposed council. Its voice would not provoke opposition; on the contrary, it would be generally accepted and followed. He believed the present body, this department of superintendence, might be made the nucleus or germ of such a council, and should that course be pursued its establishment would become easy and speedy. He believed that the way to do it.

Mr. PENDLETON, of West Virginia, was opposed to the amendment and believed that the council, if formed, should be elected by this body, or at least proposed by this body, and elected by the general association; because upon these bodies it would chiefly have to rely for the enforcement of its conclusions and acts. It could enforce nothing of itself. He saw no way to invest it with any executive power; and even its recommendations to Congress or to State legislatures, except so far as they appeared reasonable on their face, would have to depend for success largely upon the aid and support of the national association. A council of the kind proposed should be so constituted as to be able to give a great deal of time to its work, and such he understood to be the distinguishing feature of the proposed body; but it must be borne in mind that long sessions multiply expenses, and how are these to be met? A pauper institution is neither attractive nor influential. He hoped the friends of the measure, as a preliminary step, would bring forward a plan to provide means to pay expenses.

Mr. ORR, of Georgia, asked if the amendment had been seconded. He was very sorry indeed that he had not considered the matter before coming here; he thought that the association was not yet ready for the question.

Mr. TARBELL, of Indianapolis, Ind., thought if this matter failed to be decided at the meeting of the national association at Chautauqua,

we would be left exactly where we are now. He withdrew his amendment.

Mr. WICKERSHAM, of Pennsylvania, said that, as the meeting did not seem to be prepared to take action on this matter, he had the consent of the original mover of the proposition to offer the following resolution, which was adopted:

Resolved, That a committee of eleven members be appointed by the chair to prepare a plan of organization to be reported to the board of managers of the National Education Association, at its next meeting at Chautauqua the coming summer.

The chair appointed as such committee the following gentlemen: Messrs. Bicknell, Wilson, Wickersham, Harris, Hagar, Tarbell, Carleton, Smart, Gove, Shepherd, and Orr.

Mr. MARBLE, of Massachusetts, then read the following paper on the education of children who are neglected by their parents, prepared by Hon. C. D. Randall, of Coldwater, Mich., the author, in the Michigan senate of 1871, of the law establishing the Michigan State Public School for Dependent Children, member of the Société générale des prisons of France, &c.:

THE EDUCATION OF DEPENDENT CHILDREN.

I present a subject that insists upon a hearing from you as educators. It is not a new one. It has few, if any, new facts or arguments. It claims no originality. It has intruded itself into the meetings of social scientists who were gravely discussing modes of reformation and punishment, and has turned their deliberations to questions of prevention as more certain and economical. It has entered unbidden the halls of legislation, and has secured from the political economist and statesman favorable thought and action. It has entered the church and asked its healthy influence and ever ready assistance. This age more than any other has given it a hearing.

My subject is the education of dependent children by the State, for the mutual welfare of the children and the State.

So this subject through me, rather as a business man than a specialist, intrudes itself into your deliberations, into your presence—who come from the clean courts of the schools and universities and their purer atmosphere. The subject is well worthy your attention. You may not heed it now, but you will if the children of the poor are neglected and the influences of a bad education make powerful the bad elements of society. The growth of pauperism and crime if checked must be through the schools, or it never will be. It is time for efficient action.

Overcrowded Europe for ages has been oppressed with taxes to support dependents and punish criminals. We are rapidly following in her course. We can prevent it if we would. In 1850, with a population of 23,191,876, it cost us yearly $2,954,806 to support dependents and punish criminals. In 1860, with a population of 31,443,321, it cost us yearly

$5,445,143 for the same purposes. In 1870, with a population of 38,558,371, it cost for the same $10,930,429.

It will be seen by these figures that from 1850 to 1860, while the increase of population was about 28 per cent., that of the cost of crime and pauperism was a little over 100 per cent. Also, while the increase of population between 1860 and 1870 was about 44 per cent., the increase of the cost of pauperism and crime was nearly 100 per cent. From these figures we may fairly anticipate that the census of 1880 will show an increase of cost 100 per cent., making the annual cost $20,000,000 per annum. And this remarkable increase of cost in proportion to the increase of population cannot be attributed to an unfruitful soil. During these decades there has been no time when a man in mental and bodily health might not keep his family from dependence.

Surely this subject is a grave one that should not only attract your attention, but that of governments, which might well inquire into the causes of crime and dependence so as to devise methods to reduce these dangerous elements of society to the lowest possible minimum. Governments need well to protect themselves.

In times of great public disturbances, like our recent great railroad riots or like the great upheavals of the French commune, we see and feel the effects of the dangerous classes that we did not think of in more quiet times. When they come to the surface we feel their terrible effects. In more ancient times civilizations were destroyed by enemies from without. The civilizations of the future will be destroyed, if ever, by the barbarism within civilization. This barbarism within civilization decries your high schools and colleges, your free schools, and votes against taxes for their support, though it pays none. It has children to educate, but ignoring their interest would rear them in vice. It has no sympathy with those on the cultured and respectable plane above them. The riot, the commune, feeds upon and lives by this barbarism, which has its basis upon idleness, ignorance, and vice.

The mental, moral, and physical perversion of the youth is the main cause of this dependence and crime. The proper education of the youth is the one great remedy. The literature and laws of all the ages confirm this. You will find it in the Bible, in Plato, in Homer, in Confucius, and in the wisest moralists and lawgivers. Homer says: "Children belong less to their parents than to the state. They are the children of the people. They are the hope of the state. It is too late to mend them when they are spoiled. * * * It is much better to prevent the evil than to be obliged to punish it."

In speaking of the correct education of children says: Confucius aptly "It cannot be when the root is neglected that what should spring from it should be well ordered." The state has a vital interest in its youth, who must grow up either to good citizenship to sustain and protect the state, or as unworthy sons to undermine and destroy it. Pericles said

of the Grecian youth killed in battle: "The loss which the state suffers by the destruction of its youth is like the loss which the year suffers by the destruction of spring." And loss by the perversion of youth, how much more injurious to the state.

Neglected childhood, the want of school and trade education, ignorance, idleness, vice, evil associations, and their kindred influences are the causes of crime and pauperism. Children so surrounded grow up with no self-respect, no self-reliance, with no resistance to temptations, easily drift into evil ways, and once lost seldom have the desire to return to virtuous ways. Born in the county poorhouses or sent there under our indulgent laws, many even remain there, so that sometimes three generations of the same race may be found in the same poorhouse. The celebrated Juke family, brought to light through the learned investigations of Mr. Dugdale, shows through six generations 206 paupers, 76 criminals, and 128 prostitutes, all descended from one criminal and pauper ancestor. Marsigny, the distinguished jurist of France, says: "The moral perversity which has caused their ruin dates from early childhood."

I find in the last triennial report of the celebrated Mettray (France) institution for boys that the average number there in 1876 was 756. Of these, 347 were orphans or half orphans, and five-sixths entered the colony without moral or mental education. In the language of the report, "One-third of the number have had only deplorable examples, and among those whose parents live by their labor they have before them only examples of vice and idleness."

Gather statistics from whatever State or country you choose, and they all demonstrate that from dependent children — orphans, half orphans, children of pauper, criminal, or intemperate parents — come the paupers and criminals that are supported by the public. The reports of prison wardens show the following as the principal causes of crime:

In Bavaria: Neglected education and illegitimacy.

In Norway: Neglected education and want of homes.

In Russia: Neglected education.

In the Netherlands: Neglected education and second marriages.

In Sweden: Neglected education and bad company.

In Switzerland: Neglected education and unhealthy family influences.

In the United States: Orphange, want of home life.

In England: Neglected education and street associations.

These are the children that furnish the recruiting posts for the great army of dependents and delinquents. And the number of children not being educated by reason of poverty and other hindrances is very large. It was said a short time since that there were 60,000 in the State of New York not attending school and 25,000 in Philadelphia not in the regular course of instruction. In France it is estimated that there are 100,000 dependent and delinquent children. I translate from the November, 1879, number of the Bulletin de la Société générale des prisons: "It is estimated that there are in France

100,000 children under 16 years of age, who, abandoned by their parents, are living in the midst of vice and crime and form what is justly called the nursery of the jails and station houses." In this country, though we are yet far from the European condition, there must be half that number, including those in asylums and reform institutions. In 1875 there were 17,791 children in the different public institutions of New York, not including those in industrial schools, lodging houses, &c. Hon. William P. Letchworth, president of the State board of charities of New York, in a recent letter informs me that the number is now about 15 per cent. higher. The percentage of these children to the population does not vary much in the several States, except as the number is affected by density of population, as the general treatment of society has been alike in all to propagate and perpetuate this class. Growing up in idleness and vice, a large percentage of them have permanently attached themselves to the ranks of pauperism or crime. Instead of trying to save these children by moral and mental education, governments through all time have waited until the children became chronic dependents or habitual criminals, and then constructed extensive and expensive prisons and reformatories in which to confine, support, and endeavor to reform those who ought to have been saved for a better fate by preventive measures. This policy, pursued so persistently by society, has built up, encouraged, propagated, and perpetuated the dependent and criminal classes to a large extent. These dependent children have their homes on the streets, in places of low resort, in tenement houses, everywhere, anywhere to eke out a miserable existence by starving beggary, by vagrancy, and finally by crime committed to save life. In this way society forced the child to commit crime and then paid the penalty by increased taxation and a tainted society. Aside from the political economy of the subject, the humanity of it might well touch the hardest heart. The destruction of the lives and virtues of the innocents through all time has formed one of the saddest pages in the history of our race.

Save the county poorhouse, the public afforded no shelter for these children. Their only other reliance was that of private charity or the associated charity of the church, both of which were entirely inadequate for performing the great work required. And the average county poorhouse! As a rule, it would have been better for the children and for society if they had died before going there. There they were surrounded by the diseased, the insane, the idiotic, the wrecks of vicious lives. In such a tainted atmosphere the child's character took early directions in the way of permanent dependency and then crime. Children in the county poorhouses grew up in ignorance, became idle, vicious, and depraved. But this was all the public did for them; and that is all it now does for them in most of the States of this Union and in foreign countries.

But the effect of this great wrong upon the child is not limited to him; it extends to the state, especially in republican governments. In

this country the right of franchise extends to all alike. The vote of the worst man balances that of the best man in the land. The vote of both, for the safety of the state, should be an educated vote and an honest one. In our great centres of population this ignorant and low element of society is seriously consulted in politics, and has much to do in controlling legislation. But you can never cure this wrong by depriving the ignorant of the right to vote. Rights once given a people can only be taken away by the force of revolution. Moral standards so differ that you cannot establish political rights upon morals. The only remedy is the right one, and that is, secure the moral and intellectual education of the youth. The danger to society from pauperism and crime increases under our old methods in the fact that as our civilization develops the wealthy become more wealthy and the poorer become more helpless; the higher classes become more wealthy and better educated, and the poor more degraded and helpless. Add to this the fact shown, that, under the usual treatment, pauperism and crime increase out of proportion and in excess of the growth of population, and you have a combination of circumstances that tends to undermine and destroy. There have been times in France and England when 1 in 10 to 12 have been aided by charity. In the United States in 1870 it was only 1 in about 332, and Michigan only 1 in about 462. It is a serious question whether we shall follow in the path in which Europe has burdened itself with pauperism and crime, or whether, by preventive educational methods, we shall save ourselves from that fate. Society can prevent much of the evil. There should be no compromising, no temporizing.

It has been thousands of times demonstrated that most of the crime and dependence originates from intemperance; that intemperate parents have bad homes—damp, ill ventilated, and cold; that the air they breathe and the water they drink are impure. By heredity and surroundings their children are puny, defective, and diseased. These children and their parents drag out a miserable existence in hovels and almshouses. And yet the general and State governments legalize the manufacture and sale of liquor by which drunkards are made, the almshouses and jails filled, and the resources of honest labor are taxed to support the poor and punish the dependent and criminal, made so by drink. Public sentiment should demand that this should not be, and states and nations should not be partners in the unholy traffic. It should not be the exception but the rule that the first lady in the nation sets a righteous example over there in the White House. There would be little need that I should advocate here the cause of the children of the poor if State and nation would withdraw from its unholy partnership, and would suppress the business of drunkard making.

It has also been shown that the association of adults in the county poorhouses keeps up the dependent population. In one county poorhouse in one of our principal Middle States 100 children were shown

as born in that institution. This source of dependence and crime might be stopped and should.

So I might go on giving controllable causes of pauperism and crime, but they are all outside my subject, which relates to these children of the poor as we find them.

I desire, however, to give these brief statistics which repeat themselves in every State: In Pennsylvania in 1875, 1876, 1877, and 1878, there were 47,268 paupers admitted into the almshouses. Of these 5,163 were abstainers and 42,105 drinkers. During the same time there were 14,504 admitted into the penitentiaries. Of these 2,983 were abstainers and 11,521 were drinkers. This ought to be sufficient evidence to the legislator and taxpayer that intemperance is the great source of dependency and crime, and that the place to begin reform is at the bar where liquor is sold. But until that is done we must take these children of the poor, and, saving them from the fate of their unfortunate parents, separate them from evil surroundings and make them good self-supporting citizens. I urge you to continue the investigation of this subject, believing you will find it profitable for yourselves and the educational interest you represent.

Granting the need of a better education of the children of the poor, by what agency must it be done? You cannot depend upon private charity. That will only operate in places, and will fail often when most needed. The church has struggled long and well with the evil. It has built and operated asylums. Other associated charity has for years done the same work, and ragged schools, aid societies, &c., have done much. But all combined have made little impression upon the evil, that has grown faster than they could supply the wants of the class. While they worked, the State, by bad laws or omitting to make and enforce good ones, has given them more than they could do. In some cities they endeavored to remedy the evil by sending out to other States their children. This, of course, reduced juvenile crime and dependency, was economical for those cities, but expensive and unjust to the people where the children were sent, for many soon had to be supported in the reform schools and jails.

To depend on private charity to support these children is not right, for it must be done by the generous alone. Much of the wealth that is protected by a well governed people will give nothing to make these children law abiding and good citizens. All are equally benefited by having these children become good citizens, producers, and not consumers only, and all should contribute to the work according to their means.

The agency, then, to do this work is one that can command means when needed, and will see that the laws are administered so as best to contribute to the general welfare and safety. There is only one such agency, and that is the State. That power which makes the free school should see that the provisions of laws are made applicable to all classes. The State, having sufficient numbers, can most thoroughly classify and

separate defectives, dependents, delinquents in such a way as to secure intelligent and economical administration and the best results. If the State does not itself build and maintain institutions for the education of these children, for their permanent or temporary homes, it can at least follow the example of New York, which has enacted a stringent law prohibiting the keeping of children in the county poorhouses and requiring that they shall be supported in asylums or in families. There are doubtless objections to this law, but it is better than to educate children in the streets and poorhouses, to become permanent dependents or criminals. It may not be well for a State to support children in sectarian asylums, but that would certainly be better than to educate them in the schools of pauperism and crime.

THE MICHIGAN SYSTEM.

There is one State that has undertaken the work of the care and support of dependent children.

In one of the leading journals[1] of the Northwest I find, under date of the 5th instant, the following, which is an unexpected compliment from another State and similar to many expressions from the press:

"One of the noblest, wisest public charities of the country is the State public school of Michigan. Moved both by the instincts of Christian philanthropy and that farseeing political sagacity which discovers that it is the best in every way for society that indigent and neglected children be taken charge of by the State and trained for lives of usefulness, the people of Michigan have established a home and school for this class of children. And what they have undertaken to do they are doing well, doing nobly."

For humane and economic reasons the legislature of Michigan in 1871 established the State Public School for Dependent Children, the first one of the kind under any government. It is maintained entirely by the State, by taxation upon property, the same as are the public schools. It is a part of the common school system of that State, and in no sense is a part of its penal or reformatory system. It is not an asylum for orphans or defectives. It is purely a school, and is no more a charity than the district school supported by taxation, save only in the degree or extent of aid. It is a temporary educational home. Those to be admitted must be dependent on the public for support, over three and under twelve years of age, sound in body and mind. None are admitted on sentence for crime or on suspension of sentence. It is for the children of the poor, and dependence on the public is the only price of admission. Children requiring reformatory treatment must be sent to the reform school for boys in Lansing, or to the girls' reform school, soon to be constructed. This school, opened in 1874 in the buildings erected near Coldwater, is to save children from crime and pauperism. Its work begins at the source of the great river of life, which, if pure, generally

[1] The Chicago Inter-Ocean.

flows on to the ocean of eternity forever pure. Its work is all educational, which, whether here or in the common schools or the higher, is especially and peculiarly preventive. It is on the tenable ground that if you save the child you save the man.

It recognizes that a good family is the best place for a child; so this institution is only a temporary home, it being an agency to obtain, as soon as may be, a good family home for the child, where he or she is placed under a contract securing treatment as a member of the family and an elementary education, with the right in the board to return the child to the school if the terms of the contract are not executed in good faith.

The admissions are divided pro rata among the counties according to the number of dependent children in each when there are more than can be admitted. The capacity is now 300, which receives about all those who are admissible in the State. They are educated in the common branches while in the institution, where they are not kept for any definite time; only until a home is found. Some have been so affected by poorhouse or vagrant life that they require longer moral and mental training than others to fit them to go into homes. The question of their dependence is determined by the judge of probate of the county where the child belongs. A copy of his decision, containing such facts as he can ascertain from witnesses as to the child's history and the habits and condition of the parents, is sent with the child to the school, and forms a basis of his history to be kept up on the records. A sworn certificate of a respectable physician is also sent with the child, showing that it has no chronic disease and has not within fifteen days been exposed to any contagious disease.

The children are comfortably dressed, kept clean, and have pure air, and wholesome, plain food. Uniform excellent health prevails. They are trained to industrious habits. The girls assist in housework, in the care of their cottage homes, and in sewing. The boys work on the farm, in the garden, in the shoeshop, and in keeping their cottages in order. There are eight cottages with 30 children in each, and one double cottage with about 60 children. Each cottage is in charge of a lady cottage manager, who cares for the children as a mother with a smaller family, only that the cooking and eating are done in the main building and the washing in the general laundry. There are six lady teachers, who teach the children as in the district schools. Those children who prove incorrigible, or diseased in body or mind, can be returned to their counties. The institution is in charge of a board of control of three members. It is conducted by a superintendent and the usual employés of institutions. The moral and religious—not sectarian—education of the children has special attention, as required by the law. There is a Sabbath school each Sunday in the afternoon, and the older boys attend service in the forenoon in the city. Everything possible is done by teachers, cottage managers, the superintendent, and all who have directly to do with the

children, to secure good discipline, good conduct, and establish a good moral character, so they will be fitted as much as possible while in the school to become good citizens—industrious, self-supporting producers and not consumers only.

Since the opening of the school over 700 have been received and over 400 placed in good family homes.

Indenturing children.—It is made the special duty of the board of control to secure homes for the children. The school is thus a half-way house from dependence to a family home. A person applying for a child must have a written recommendation from an agent of the State board of corrections and charities, one of whom is appointed for each county. He must certify that he has made full investigation, and that in his opinion the home will be a good one for the child, and that the applicant will faithfully execute the contract, which, among other things, requires that the child shall be treated as a member of the family, and shall attend the district school at least three months each year. No child can be indentured to an intemperate person or to one who sells liquor. Whenever in the opinion of the board the contract is not complied with, the child is returned to the school and a new home found. This is always done where the child's welfare appears to require it. Under one provision of law the child may be adopted through the probate court, a proceeding which has been had in numerous cases. In case of such adoption the child becomes the heir at law of the person adopting, and then its relation with the school ceases. The new home of the child is selected with great care, and the future of the child is carefully watched over as by a jealous parent by the agents in the several counties and by others at the request of the superintendent. Reports are had from the children at least twice a year. The guardianship of the board continues during minority. No institution supported by private or associated charity ever watched over its children more closely than do the officials of this school, assisted by the county agents. Everything possible is done for these little waifs that could be wished by the most humane. In their cottage homes, in their schools, and in families they have everything done for them consistent with their highest good. The good of the child takes precedence in all questions.

The general physical, moral, and mental condition, the behavior, advancement in schools, &c., of these children compare favorably with their more fortunate brothers and sisters in the district schools.

Some of the results.—First, children more readily find homes from this school than from the county houses. They are not considered paupers, but State children, and there is not the same discredit attaching to them as to county-house children. A few weeks in the school cleans them up, shows them what discipline is, that some one cares for them, and removes the poorhouse look, and the child appears as a new creation. Good examples, correcting and elevating influences from teachers, managers, their companions, and others soon effect a great change with the

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worst. Such children so improved find homes when they never would from the county houses, except it be to graduate to the houses of correction or the prison. Here comes in a great economic advantage to the State, that by sooner being placed in families the sooner is the public relieved of their support. In one county three children had in the aggregate 29 years of support, while their aggregate support in the school was not three years. Second result: It is found in this State that there is little difference in the direct cost of maintaining and educating a child for a year in this school and in the county poorhouses. One hundred and twenty dollars each per annum is what the State provides for 300 children in the school on the average, and it has not on the average cost that. Add to this the 100 that go out into families each year (last year the net gain was 115), who have to be clothed, and the cost is $90 per annum for the 400 cared for during the year. This is at a less cost (as shown by the official reports from the counties to the secretary of state) than it is for each child supported in the county poorhouse. This economic showing is very gratifying to the friends of the school. The taxpayer wants figures, and we can show them here, and they cannot be impeached. Add to the result here shown the fact of the shortened term of support by the public, and the showing is very much stronger. Third result: This school has only been in operation about six years, so that the effects upon the children cannot be fully shown. Enough is known, however, to satisfy us that there are very few of the children who go through the school who will not prove as good in morals and life as the average children in the community. I could not place the loss as low as 5 per cent. There are occasionally children sent here who inherit traits from insane parents, who cannot be cured. But they are improper inmates and rather belong to schools for the feeble-minded, and should not be considered in the estimates, though all have been. It is undoubted that the large mass of these children would in time have become permanent dependents and criminals, and it cannot be doubted that through the care and education given them by the agency of this school, the great majority of them will become good citizens. It is expected that the more this school is known to our people the more its influence for good upon the children will be increased. Our people appear satisfied with the results so far, and there is no more popular institution in the State among the people than this. The principles upon which it is based are believed to be right. The prominent features of the system are—

1. The radical separation of innocent from criminal children.
2. Education in a home by the State, under educational and moral influences; this home to be temporary.
3. Restoration to family homes as soon as children are fitted for them.

RESULTS ELSEWHERE OF PREVENTIVE EDUCATION.

I cannot close this outline without calling attention to the effects of educational preventive work elsewhere among the children. There has

of late been much done for these children in Germany, France, and England, and the results are very satisfactory.

In *England* it is estimated that over 400,000 have passed through the ragged schools, more than 100,000 have been placed out to trades and service, and more than 50,000 saved from a life of crime. Crime in one county named, in 40 years, has decreased over 300 per cent. Reports say that "this work has been effected in a large measure through the agency of reformatory institutions, industrial schools, training ships, refuges, homes, and such like establishments."

The directors of convict prisons in 1877 in England record the decrease of crime, and say that the development of the criminal classes has received a permanent check by the means adopted in recent times of cutting off the sources of crime by caring for dependent and delinquent children. They say that in 1836, with a population of fifteen millions, 10,125 were sentenced to imprisonment, 3,611 to penal servitude, and 4,273 to transportation to Australia; whereas in 1875, with a population of twenty-three and a half millions, only 9,282 were sentenced to imprisonment and 1,639 to penal servitude. Sir Charles Reed, chairman of the London board of education, in a recent address speaks of the decrease of juvenile crime in that city under the operations of the new system, by which the children of the poor are compelled to attend school. He says:

"The acknowledged diminution of juvenile crime in the metropolis may fairly be traced to the withdrawal of so many children from the streets. In the whole of London the number of arrests on suspicion of children under sixteen was, in 1877-'78, 294 boys and 60 girls, being the smallest number for simple larceny within a decade. * * * We do not, indeed, suppose instruction will, in itself, suffice to work moral reformation, yet it is noteworthy how closely ignorance and crime do work together. In 1877 there were arrested 75,250 persons who could either not read and write at all or could do so only with great difficulty, while only 2,732 were arrested who could read and write well."

Scotland.—In Edinburgh the number of children committed to prison in 1847 was 512, and in 1875 the number was reduced to 131. In Aberdeen the average yearly number of thefts reported to the police during the five years ending 1860 was 1,142, while the average yearly number during the five years ending 1874 was 286, and in September, 1875, not a single case was set down for trial, the like not having occurred for more than a hundred years. The judge, in his remarks, imputed this result to the industrial and reformatory schools. This shows the world need not grow worse if the children are looked to.

Germany.—There are few statistics from this country in my reach. Those from the noted Rauhe Haus for children, near Hamburg, are quite gratifying, showing that a very large percentage of the children are saved by educational and reformatory treatment.

France.—There is to-day no country where there is more intelligent

discussion and work in regard to dependent children going on than in France. The Société générale des prisons, composed of some of the ablest men of the country, and the "Conseil supérieur des prisons," an official organization, are earnestly at work devising methods to educate and save these children. There has just been organized a national society to take care of the work for these children, at the head of which is M. Bonjean, a noted judge advocate. Intelligent positions are taken and maintained there by the highest authorities. M. Victor Bournat says:

"Every nation has a profound interest in the good education of all its members; it is the right as well as the duty of the state to enforce this principle; neither the misfortune nor the fault of parents ought to shut the door of the school against their children and deprive them of all moral training; * * * the child badly brought up must necessarily become a cause of trouble to society, since the idler and vagrant will soon pass into the criminal; if the state ignores its right or neglects its duty toward these children it cannot in fairness hold them to a strict account for their acts." The eminent Victor Cousin says: "I am filled with wonder and grief that so much attention is given to prisons and so little to schools." The venerable and distinguished M. Charles Lucas, member of the Institute, has given to correctional education the best work and thought of his life for over the last forty years. Many distinguished French names could be cited showing the deep interest France is taking in the welfare of her 100,000 dependent and delinquent children. The best results may be expected at an early date from that country.

America.—There has been within the past few years a marked reduction injuvenile crime in those great centres of population where the education and care of children have received the most attention. We must look to the next census for results. There are many preventive agencies at work, with excellent results, and many States are moving in the adoption of better methods to educate and save their dependent children.

There can be no question that prevention is safer, and more certain and economical than punishment or reformation, and that the national and State governments cannot act too soon in improving their methods—their systems. And let me say that right here in this District is the place where an example might well be given to the whole country. Michigan, by its system of care and education of dependent children, has supplied the "missing link" in our educational methods, and the District, for its children, might well profit by the example. The institutions of this District are seen by all the world. They stand out in relief more than any others in the land. Here for this people should be secured the fullest republican rights, the purest form of republican government. All the best elements of our educational systems might well be here moulded into the one perfect system, and here might well be made by

the General Government a model of educational methods which should show to the world what a free press, free speech, free thought, and free work can accomplish in the New World. And prominent in the educational system might well be an educational home for the children of the poor, like that in Michigan, of which the distinguished and venerable Drouyn de Lhuys, of France, lately said, addressing the Institute of France:

"Behold, gentlemen, the State of Michigan, only about forty years old, has the merit of being in advance of ancient Europe in the inauguration of a new era for indigent children."

(For laws relating to the establishment of the school at Coldwater, see Appendix A.)

Mr. WILSON, chairman of the executive committee, then announced the programme for the next day, and the department adjourned until the evening.

SECOND SESSION—THURSDAY EVENING.

WASHINGTON, *February* 19, 1880.

The department reassembled at 7.30 P. M.

Hon. J. H. SMART, of Indiana, submitted a report prepared by him on the "Best system of schools for a State," as follows:

THE BEST SYSTEM OF SCHOOLS FOR A STATE.

GENERAL PRINCIPLES.

I. The school a State institution.—As viewed by the people of the United States, one of the parts of the United States called a State or Commonwealth is an institution which has for its purpose the realization of freedom in all its citizens.

It must exercise all those functions necessary to this end except such as are delegated to the General Government of the United States.

Rational freedom cannot be realized without general education.

Experience has shown that voluntary associational enterprise is not adequate to secure general education, and that education will not become general unless it is fostered by a system of wise laws.

It is, therefore, the duty of the State to provide by law for a thorough and efficient system of schools which shall be equally open to all.

II. The system must be compulsory.—It is not enough that the State makes by its laws a system of schools possible. The system must be a compulsory system. The State should compel the location, establishment, and maintenance of a sufficient number of schools for the education of all its children.

If it were left to each locality to establish schools or not at its will,

the system would in no sense become a general system. A permissive system would soon become no system at all.

III. The doctrine of equalization.—All the citizens of the State are governed by the same system of laws. The laws of the State are an outgrowth of the intelligence of the citizens. A limitation of intelligence is a limitation of citizenship, and ignorance on the part of some is an abridgment of the liberty of others. Hence every citizen is benefited by and therefore has an interest in the intelligence of every other citizen.

Thus an equalization of benefits arises from a uniform school system; upon this is based the doctrine of equal obligation.

In the maintenance of a general system of schools the State should therefore establish the principle that the property of the State should educate the children of the State. It should therefore levy and collect a tax upon the property of its citizens, and the proceeds of this tax should be equally distributed among the children of the State, and should be used for tuition purposes only.

IV. The executive agents of the State.—The State should appoint for itself suitable agents or officers, by which a general inspection and supervision of the whole system can be secured; but in the formation of a school system and in the management of schools the State must operate chiefly through certain local agencies. These agencies must be limited in their operation by certain definite geographical boundaries. In each of these localities the State must provide for the appointment of necessary local agents or officers, by means of whom schools can be established and maintained. While each locality may be left to select its own school officers, the State should require this selection to be made, and it should compel the officers to execute its will in regard to the establishment and maintenance of schools under suitable penalties.

V. Unification in township, town, and city.—In most States local corporations for municipal purposes have already been formed; these are called cities, towns, and townships. For obvious prudential and economic reasons the geographical units of school corporations should be coincident with these civil corporations. There should thus be formed within each municipal corporation a school corporation independent of it, but conterminous with it. These school corporations may be combined, as in a county, parish, or district, for certain purposes; but they should be in a measure independent and should form the units of the system.

As a matter of convenience, subdistricts may be formed in school corporations. Unequal distribution of population, the condition of roads, bridges, &c., make it impracticable to fix by general statute the geographical boundaries of subdistricts. As population increases or shifts, and as the condition of roads and bridges is improved, frequent changes in the boundaries of subdistricts must be made; this is especially true in new States. If these changes in boundaries of subdistricts could be

made without limitation by the people themselves, schools would be multiplied almost indefinitely. Hence, districts should be formed and houses located under the authority of the school boards of cities, towns, and townships, and not under the authority of each subdistrict. In each township, town, or city, all the subdistricts should form one system and no more, and should be under the control of one board of school officers. The necessities of the case in respect to the location of schools, in respect to the combination of districts for the establishment of central graded schools, and economy in the matter of levying local taxes and in the management of the revenues arising therefrom, require a unification of all the schools in the township, town, or city under one board of control.

VI. *Extent of local control.*—The local agents may be permitted to exercise discretionary power in respect to those things which do not necessarily affect the quality of the school. Hence they may be left to locate and construct their own school-houses, and to supply them with furniture, apparatus, &c., through the means of local taxation. But the State should compel this work to be done under such safeguards and restrictions as will secure a sufficient number of houses, in proper locations, with due regard to such sanitary conditions that the health of the children will not be liable to injury. They may be left also to prescribe the course of study, with certain limitations, and to make all useful rules and regulations for the thorough organization, management, and discipline of the schools.

The local authorities may employ and contract with teachers, and fix their wages, under such restrictions in respect to their examination and supervision as will secure for each of the schools of the State thorough and efficient instruction and discipline.

VII. *Scope of the school.*—Each school corporation should be required to establish and maintain such advanced schools as the attainments of its children may require, and to supplement the State tax by a local tax to maintain these schools. The necessity for giving cities and towns the power to establish schools of a higher grade has been so often discussed that the committee deems it unnecessary to do more than express the opinion that the establishment of such schools is not only wise, but necessary. The necessity for such schools in townships or sparsely settled towns, however, is not so generally recognized. The committee, therefore, expresses its opinion that authority should be given to the school boards of townships also to establish central graded schools. By the establishment of such schools there would be found an educational centre in each township, from which would go out an influence that would be of great advantage to the entire community. Such schools would not only be a benefit to those who attend them, but they would also relieve the district schools to such an extent that much more efficient work could be done in them.

VIII. *The relation of the teacher.*—The school system being general

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and the schools being State institutions, the teachers should be regarded as agents of the State to execute its will rather than the will of the localities in which the schools are situated.

The State should provide agencies for fixing a uniform standard by which the qualifications of all the teachers can be tested.

This work cannot be left exclusively to local control.

While the local authorities may select the teachers, the selection must be made from among those that have been duly examined and licensed by professional experts acting under the authority of the State.

The State should also provide the means by which the work done by the teachers in the school rooms can be intelligently inspected and supervised.

Inasmuch as the true test of a teacher's value must be made in the school room, all licenses issued to those having had no experience should be regarded as probationary licenses, and the same officers who examine and license teachers should be required to inspect the schools.

Since no system of schools can be properly maintained without the education of teachers at the expense of the State, the establishment of normal schools and teachers' institutes under the control of State authority is required.

IX. Special schools.—Inasmuch as children who are blind, deaf and dumb, or idiotic have a right, in common with other children, to demand from the State educational advantages, it is no less the duty of the State to establish suitable institutions for their education and training than to establish its common schools.

Such institutions should be based as much upon the idea of rightful demand as upon the idea of benevolence. They should be, as far as is practicable, subject to the same general principles that control and govern the other educational institutions of the State. All special institutions that receive the benefaction of the State should be subject to inspection by suitable State officers appointed for that purpose.

THE SYSTEM OUTLINED.

I. Of the State superintendent.—The State needs an agent to take general supervision of its schools and of its school funds and revenues. It needs a skilful schoolmaster general to visit the various localities and awaken interest in public education; to advise subordinate officers and teachers in respect to their duties; to interpret the school law to them; to determine certain matters of general interest that may be taken to him on appeal; and to inform the law making power of the State concerning the condition of the schools and the reforms which are needed to make them more efficient and valuable. A commander in chief is no more needed for the proper organization, equipment, and management of a great army than a general superintendent is needed for a great system of common schools.

The efficient performance of the multifarious duties required of a State

superintendent of public instruction necessitates experience in the performance of those duties. The successful administration of the office depends also in a very large degree upon the confidence which teachers and school officers have in the judgment and in the ability of the State superintendent. A person may perform as efficient service in some official relations during the first week of his administration as during the last week of it, even though he may be unknown to most of the people whom he serves. This is not true, however, of a State superintendent of public instruction. It is desirable, therefore, that the term of service of the State superintendent should be not less than four years. He may be elected by the people, or appointed by the governor or by the State board of education.

II. Of the State board of education.—An examination of the school systems of the several States makes it apparent that there should be associated with the chief executive school officer a suitable advisory council.

This council should form a State board of education. It should be empowered to grant life certificates to persons of superior scholarship and high professional ability; it should exercise supervisory control over the higher educational institutions supported by the State, and especially over the State normal schools; it should examine and license all local officers authorized to examine and license teachers in the various school corporations of the State, and it should have the power to instruct and direct these local examiners in regard to the standard of qualification required of candidates for license, and in regard to the preparation of questions to be used in their examination. It should also exercise some control over the management of county or district institutes established for the instruction of teachers.

From the duties required of the State board of education it will be seen that its members should be selected from among the profession chiefly, and the various school interests of the State should be represented upon the board. The board may properly be composed of the State superintendent of public instruction, the governor of the State, the State's attorney general, the president of one of the State normal schools, the president of the State university, if one exists, with not less than three other persons who are engaged in teaching or in the business of supervising schools.

III. Of the county superintendent.—In order to secure thoroughness and efficiency on the part of the teachers, their work must be systematically and intelligently supervised. It is impossible for the State supertendent or for the State board of education to thoroughly supervise the work of all the teachers employed under a State system. The State must depend upon local agencies for this necessary work. The work cannot be left to the non-professional local school boards already provided for, but it must be performed by professional experts, properly licensed by State authority.

The necessity for local supervision is already so generally recognized by city school authorities that almost every city in the country has its city superintendent. Thorough and efficient supervision has been the chief agency in bringing the city systems to their present standard. But the necessity for the supervision of ungraded schools in townships has not been so generally recognized. If cities, with the advantages of well graded schools, of a long term, and of well trained and experienced teachers, need supervision and derive so much benefit from it, the ungraded schools in townships, with all their disadvantages, cannot be expected to do superior work without it. The arguments in favor of supervision of ungraded schools in townships are unanswerable. No prudent man would employ a gang of workmen on a farm or in the shop without devising some means by which their work could be efficiently supervised. Every mill must have its manager, every railroad its superintendent, every contractor his head workman, every merchant his chief clerk, and every machine shop its master mechanic. In every business of life, as well as in every department of government, there must be systematic organization of labor, with intelligent supervision. The highest purposes of ungraded schools in townships cannot be realized without such supervision.

Thorough supervision necessitates frequent visitation. The number of schools which one person can efficiently supervise depends very much upon varying local circumstances, among which are density of population, the advancement of the schools, and the condition of roads, bridges, &c. The territorial divisions for this purpose may thus be large or small, as circumstances may require. But, inasmuch as the various townships are generally combined for certain civil purposes and form counties, it is believed that, in most of the States at least, each county should form a territorial division for the purpose of securing supervision of district schools. The system of county superintendency is, therefore, commended. The county superintendent should be required to visit and inspect all the schools under his supervision at least twice each year. The county superintendent should, with the exceptions hereinafter mentioned, examine and license the teachers, under the authority of the State board of education. He should have authority to revoke licenses issued by him, for proper cause, on petition of the patrons of a school. He should advise the local school officers in respect to their duties. He should hold county and township meetings for the instruction of the teachers, under the authority of the State board ot education. He should hear and determine appeals from the decisions of subordinate officers in certain local matters, and he should be a medium of communication between the State superintendent and the subordinate school officers of the State. The same reasons that make it advisable that the State superintendent should hold his office for a long term make it advisable that the county superintendent should hold office for a long term. He may be elected by the people, or appointed by the

county board of education or by some other competent local authority, but no one should be eligible to the office of county superintendent who does not hold a certificate of qualification from the State board of education or from the State superintendent of public instruction.

IV. Of city and town examining boards.—For obvious reasons cities and towns employing a city or town superintendent should be exempt from the supervision of the county superintendent, and the teachers of such corporations should be examined by a board of examiners appointed by some city or town authority, and not by the county superintendent. But such examining boards should operate under the same restrictions in respect to the examination of teachers that govern the county superintendents.

V. Of the county board of education.—The school officers of the several corporations in a county may be organized into a county board of education, with the county superintendent as its president or secretary. This board might have authority to appoint the county superintendent, but its additional powers should be chiefly advisory. Such a board might consider the general needs and wants of the schools of a county, and make such general rules and regulations as might be thought advisable. By mutual agreement the representatives of the various corporations might coöperate with each other in respect to text books, reports, teachers' meetings, &c., to the end that the efficiency of the schools might be increased.

VI. Of local boards of school trustees.—The State should provide for the election or appointment by some competent local authority of a suitable board of control for the schools in each township, town, or city. These boards, although selected by the people, should be the agents of the State to execute its law in respect to the schools.

These school boards, being compelled to establish and maintain a sufficient number of schools for the education of the children in their respective corporations, must necessarily have the power to levy such local taxes within certain limitations prescribed by law as they may deem necessary for the purpose.

They must have power to prescribe a course of study; to grade their schools; select, employ, and contract with their teachers, being limited in their selection to those who have been duly licensed; to fix their compensation and to dismiss them for cause; and to make such rules and regulations in regard to the schools as may be necessary to secure efficiency and economy in their management.

School boards of cities and towns of a certain class should have power to appoint a city or town superintendent.

School boards should each consist, ordinarily, of three members. Cities and towns of a certain class, however, should be permitted to increase the number if found necessary. The members of each board should be elected for not less than three years, and no more than one-third of the members of a board should retire from service each year.

VII. Of the power of the patrons.—The patrons of a school attached to a district in a township should have power to meet and petition the school board in regard to the building, removal, or repairs of a school-house, and in regard to the formation of a new school district. They should also have the power to petition the school board of a township to dismiss a teacher, and to petition the county superintendent to revoke a teacher's license for cause. The moderator or director should be the medium of communication between the patrons of the schools and the school board of the township, and should, under the direction of the school board, be the immediate custodian of the school-house and school premises when not in use for school purposes. For obvious reasons no such meetings should be provided for in cities and towns.

VIII. Of the selection of teachers.—The teachers should be selected and appointed by the respective school boards of townships, towns, and cities, and not by the patrons of the schools in the subdistricts. A more hearty coöperation on the part of the patrons of the school, greater efficiency and more perfect impartiality on the part of the teachers toward the pupils, and longer tenure of service for the teachers will be secured by this method of appointment rather than by election by vote of the patrons of the schools.

IX. Of the licensing of teachers.—No person should be permitted to teach in the public schools without possessing a valid license issued by some proper State or local authority, which license should be issued only upon a thorough examination. The purpose of this examination being to protect the children as well as the treasury, it is not enough to provide that persons who teach in the public schools without a license should forfeit all compensation for services so rendered, but local school officers should be absolutely prohibited from permitting unlicensed persons to teach or to take charge of a school. Persons should not be allowed to learn the business of teaching school at the expense of the children.

X. Of moral character.—Inasmuch as moral worth is of quite as much value as scholarship, the law should require all persons applying for a license to teach in the public schools not only to be examined in respect to scholarship, but to present to the examining authority satisfactory evidence that they possess such qualities of mind and heart as would lead them to cultivate in their pupils those high moral qualities so essential to successful living.

XI. Of the limitation of licenses.—For reasons already stated, all licenses granted to those who have had no experience should be regarded as trial licenses, and until teachers have obtained a good degree of professional skill, as shown by successful work in the school room, the law of frequent examination should be applied to them, and their licenses should be for but a brief period.

When such skill has been attained, local authorities should have power, by and with the approval of the chief educational officer of the

State, to issue licenses for a longer period, say for eight years. Such persons as are found, upon a thorough and critical examination by the State board of education, to possess eminent scholarship and high professional skill should be licensed by such board for life.

All licenses issued by any examining authority should be limited to the territory over which such examining authority has supervisory control; and each examining authority should have power to revoke licenses issued within its jurisdiction, but only for certain specified causes, and upon fair trial.

XII. Of the tenure of office of teachers.—The question of the continuous service of the teachers is regarded as a very important one. The law should, so far as practicable, encourage such continuance. In all the provisions of law in regard to the time of electing school officers, to their term of service, and to the issuance of licenses to teachers after suitable probation, and to the mode of selecting and appointing them, the desirability of a long term of service for teachers should be kept steadily in view.

XIII. Of the independent authority of teachers.—Teachers should possess some independent power in the management and in the instruction of their schools.

Within the limits prescribed by law and by the rules and regulations adopted by the respective school boards, the teacher's authority in the school room should, for the time being, be the supreme authority. Within these limitations teachers should have authority to make their own rules and regulations, discipline the school in their own way, and use their own methods of instruction.

A SYNOPSIS OF THE SYSTEM.

I. Territorial division.	*III. Institutions, general.*
II. Officers.	*IV. Institutions, higher and special.*

I. Territorial divisions: (*a*) State, (*b*) county, (*c*) township, town, or city, (*d*) school district.

II. Officers: (*a*) State superintendent, (*b*) State board of education, (*c*) county superintendents, (*d*) county board of education, (*e*) trustees of townships, towns, or cities, (*f*) director or moderator of districts in townships.

III. Institutions, general: (*a*) City and town graded schools, (*b*) city training schools, (*c*) ungraded district schools in townships, (*d*) graded schools for townships, (*e*) professional associations: (1) County institutes, (2) county institutes for teachers, under supervision of county superintendent, (3) township and town institutes for teachers under supervision of county superintendent.

IV. Higher and special institutions: (*a*) State university, (*b*) State normal schools, (*c*) agricultural and industrial schools, (*d*) special schools: (1) School for the blind, (2) school for the deaf and dumb, (3) school for the idiotic, (4) school for orphans, (5) reformatory schools.

I. Territorial divisions.

A. State: (1) Should compel the establishment of schools; (2) should provide for a uniform system; (3) should fix the minimum length of the school year; (4) should fix certain prescribed subjects of study; (5) should exercise general superintendence; (6) should levy a general tax; (7) should provide for the proper management of the school funds; (8) should provide for the professional education of teachers; (9) should establish reformatory and benevolent schools; (10) may establish universities and professional schools.

B. County: (1) Should exercise a limited general supervisory control over its schools; (2) should appoint a county superintendent; (3) should have a county board of education; (4) may secure uniformity in text books.

C. City, town, or township: (1) Should be left to the local control of its schools; (2) should select its officers; (3) should build its own houses; (4) should select its own teachers from among those that have been duly qualified under the laws of the State; (5) should be permitted to levy local taxes for the building of houses, &c.; (6) should be permitted to levy local taxes for the continuance of the schools beyond the minimum period fixed by the State; (7) should be permitted to levy local taxes for the maintenance of schools of an advanced grade.

D. Districts: (1) Districts should be formed for the purpose of localizing the patrons of the school; (2) should have an advisory power in the selection of teachers and the erection, removal, or repair of schoolhouses; (3) districts in cities and towns should not be formed by any provision of the general statute, but their formation should be left to the discretion of the school boards of cities and towns.

II. Officers.

A. State superintendent: (1) Should be a constitutional officer; (2) should be appointed by the governor or by the State board of education, or be elected by the people; (3) should serve for a period of not less than four years; (4) should have general superintendence of the schools; (5) should supervise the management of the school funds and revenues; (6) should make reports to the governor or to the legislature; (7) should receive necessary reports from subordinate officers and prepare blank forms; (8) should construe the school law; (9) should hear appeals in certain cases; (10) should visit county institutes; (11) should have authority to call school officers together in various localities; (12) should be a member of the State board of education; (13) should have some supervisory control over institutions for the professional education of teachers; (14) should exercise some supervisory control over the State benevolent and reformatory institutions.

B. State board of education: (1) Should hold office by virtue of some official educational position; (2) should constitute an advisory council

to the State superintendent; (3) should examine teachers for State certificates; (4) should examine and license candidates for the office of county superintendent; (5) should prepare questions for the use of county superintendents in the examination of teachers; (6) should have power to instruct county superintendents in regard to the examination of teachers and to the management of institutes.

C. County superintendent: (1) Should be a teacher of recognized ability; (2) should be appointed by the county board of education or elected by the people; (3) should be required to hold a license from the State board of education; (4) should hold office for a period of not less than four years; (5) should have general supervision of schools, except in certain cities and towns employing a city or town superintendent; (6) should visit the schools in the county, except in such cities and towns; (7) should examine and license teachers under the authority of the State board of education, except for such cities and towns; (8) should have power to revoke licenses for cause; (9) should conduct county and township institutes for the instruction of the teachers under his supervision; (10) should carry out the instructions of the State board of education; (11) should be the executive officer of the county board of education; (12) should receive reports from subordinate school officers; (13) should transmit reports to the State superintendent of public instruction; (14) should be a medium of communication between the State superintendent and the State board and subordinate school officers; (15) should hear appeals from decisions of local officers in respect to certain local affairs.

D. County board of education: (1) Should be composed of the school trustees of corporations which are under the supervision of the county superintendent; (2) should consider the general needs and wants of the schools under its charge; (3) should seek to unify the school work; (4) should arrange a course of study; (5) should make general rules and regulations in regard to the employment of teachers, time of commencing schools, the government of the schools, and the conduct of the teachers and pupils, &c.; (6) may adopt text books.

E. Trustees of townships, towns, and cities (first, trustees of townships and towns): (1) Should be three for each corporation; (2) should be appointed by some competent local authority or elected by the people; (3) should serve for three years, one retiring annually; (4) should receive school revenues; (5) should have power to levy local taxes, within specified limitations, for grounds, buildings, furniture, repairs, supplies, apparatus, &c., and for library purposes and for additional tuition purposes; (6) should be compelled to locate, establish, and maintain a sufficient number of schools for a certain number of months in each year; (7) should have power to abolish old school districts, create new ones, build and remove houses; (8) should be compelled to make provision for instruction in certain prescribed branches; (9) should have power to establish township or town graded schools; (10) should have power

to provide instruction in branches additional to those prescribed by law; (11) should employ and contract with teachers, being restricted in their selection to those who have been duly licensed by competent authority; (12) should properly account to proper officers for all school revenues that come into their hands; (13) should receive reports from teachers and should transmit reports to the county superintendent and other county officers; (14) should have authority to dismiss refractory pupils from school; (15) should be prohibited from contracting debt; (16) should carry out the orders of the county board of education in respect to course of study and text books.

(Second, trustees of cities and towns of a certain class) appointment, powers, and duties same as other trustees, except: (1) The number of trustees may be increased; (2) they should provide for the examination of their own teachers by a suitably constituted committee; (3) may appoint a town or city superintendent; (4) should make their own course of study; (5) should make their rules and regulations; (6) should select their own text books; (7) should grade their schools and provide for promotion of pupils from grade to grade; (8) should be exempt from the control of the county board and the supervision of the county superintendent; (9) but they may be compelled to make certain reports to the county superintendent, as are other trustees; (10) may establish city or town training schools for the instruction of teachers.

F. Directors or moderators of districts in townships: (1) Should be appointed annually by voters at school meetings; (2) should preside at school meetings and record their proceedings, and should communicate the wishes of the patrons to the trustees.

(For an outline of the school systems of the various States, forming a part of Mr. Smart's report, see Appendix B.)

Mr. WICKERSHAM said that, though a member of the committee, he had not participated in the preparation of the report, and, so far as he was concerned, the whole credit of the paper, which was considerable, belonged to the chairman, Mr. Smart. It was on a practical and very important matter, and should be printed and considered hereafter.

Mr. PHILBRICK said that the paper just read reminded him, by its exhaustive consideration of the subject, of a paper prepared a few years ago on the "American system of education," by Dr. Harris, he supposed, and which had been translated and widely read in Europe. He (Dr. Philbrick) had included this paper in his Catalogue of the Educational Exhibit at Paris in 1878. The paper just read, giving the framework or organization of educational systems as they now exist or as they should exist in the several States, must be of permanent value and he thought should take rank with its predecessor, the paper referred to.

General HOVEY hoped that the author of the report would amend it before printing, so as to exclude the idea of having school superintendents and boards appointed. It is safer, he thought, that they should in

all cases be elected by the people. The evil effect of the appointment system could be seen, if one cared to study the subject, in the executive Departments of the National Government, where the appointees soon learn that safety lies in the direction of having no opinions of their own. The same evil influence operates upon school officers who owe their position to the favor of some individual. They are apt to become mere echoes of the men who appoint them. Besides, the men who appoint are usually politicians, with, presumably, little fitness to select school officers anyhow, and then they are under great temptation to use these school positions to pay off their political friends. He hoped the department would not oppose the American idea of popular election for school officers.

Messrs. HARRIS, BEARD, and HOYTE made further remarks on the paper; when, upon motion of General EATON, it was ordered to be reported, with the approval of the department, to the national association in July.

Mr. HOYTE then submitted a resolution commending Mr. Randall's paper on the education of neglected children. Adopted.

Dr. D. C. GILMAN addressed the department on the subject of "University education," with special reference to the plans and methods of the Johns Hopkins University, of which he is the president. The address contained an exposition of the principles which have governed the foundation of the Johns Hopkins University and of the hopes by which its managers are inspired. After a reference to the reasons why universities are of special interest to Americans just at this time, the speaker pointed out the difficulties which beset such organizations from the historical traditions which we inherit, from the false nomenclature which has been adopted, from disagreement as to the proper source of authority (whether it is church or state or private enterprise), from an inadequate apprehension of the necessary cost, and from the difficulty in finding eminent professors in a period when so many other opportunities of intellectual advancement, ecclesiastical, political, editorial, literary, and scientific, absorb the best scholars. Attention was next called to the need of maintaining a clear distinction between universities and their allies, the college on the one hand, the learned academy on the other; to the worth of original investigators and researchers for their double influence in advancing knowledge and in attracting scholars; to the importance of liberal supplies of books and instruments rather than of showy buildings; to the value of university training to those who receive it; finally, to the great benefit conferred upon society at large by the amplest encouragement of literature, art, and science. The opportunities of this country were then referred to: its freedom in such matters from the control of one church or one government; its readiness to receive and act upon new impulses; its hospitality to merit wherever discovered; and its rapid advancement in material posperity. The speaker then described from his acquaintance with young men and from the study of biography the influence which universities have had in

discovering, developing, and bringing forward young men of power and talent. He dwelt at some length on the marvelous advances now making in mathematics, physics, chemistry, biology, and medicine, as well as in the study of history, language, logic, philosophy, and religion, and the part which universities are taking in this progress.

In the opinion of the speaker the world is now going through a period as important in the advancement of society as that which we call the Renaissance. Discoveries follow one another with marvellous rapidity. Light shines where darkness has prevailed. Steam and electricity are to us what movable types and the mariner's compass were in the fifteenth century. One or two or three centuries hence the historian will look back upon this last half of the nineteenth century as we look back to the fifteenth century, and will see what we are too near to appreciate fully, but of which we are all more or less conscious: that we live in a transition period, when mankind is advancing with a rapidity never known before. He will see that in our day the fetters of human thought fell away, and that better health, better education, and better morals were developed in old societies, and were carried to new states by the triumphant power of Christian civilization. We hear the revival of letters spoken of as dating from the overthrow of Constantinople and the migration to Italy of companies of learned Greeks. Let us not forget that two hundred years before the Reformation and the revival of letters, one hundred and fifty years before the invention of printing, universities began to flourish. In their walls were planted and nurtured the germs which blossomed in the discovery of a new world, in the restoration of classic letters, in the beginning of modern literature, in the initiation of scientific research, in the diffusion of books by the press, and in the emancipation of the human mind from dogmatic authority. Let us see to it that in our day likewise full scope is given to the loftiest and ablest plans of university organization.

Remarks were made on Dr. Gilman's paper by Messrs. Shepherd, Marble, and Hoyt.

The department then adjourned to Friday, the 20th, at 9 A. M.

After adjournment the committee on the proposed "national council of education" held a session at the Ebbitt House. They will report to the national association in July.

THIRD SESSION—FRIDAY MORNING.

WASHINGTON, *February* 20, 1880.

The department met pursuant to adjournment, and was called to order by the president, Mr. Newell, at 9 o'clock.

Mr. DICKINSON, of Massachusetts, read a paper on the high school question;[1] after which

Rev. RUSSELL A. OLIN explained to the department the apparatus known as the

TIME GLOBE.

Gentlemen of the association, the apparatus which by the courtesy of the association we have the pleasure of introducing to your notice is made up of two very common instruments, a clock and a globe, with the value and uses of which everybody is supposed to be familiar. Whatever title, therefore, this piece may have to your special attention and interest as representing the cause of education in its progressive demands, will not be found in the mere juxtaposition of these common instruments, but in their realized mechanical coöperation, the result of which, we shall hope to show, has been greatly to simplify some of the fundamental questions of geography as taught in our schools; in fact, as an eminent scientist has said, "to illustrate more problems connected with a rudimentary knowledge of this science and in a simpler manner than any other apparatus available at anything like its cost."

The instrument is called the time globe, concerning the construction of which, before proceeding to speak of its uses, I ask your indulgence while I quote from the unqualified indorsement of Dr. B. S. Lyman, the well known professor of astronomy and physics in Yale College. After a critical examination he speaks of it, first, as "an admirable combination of a large globe and a good timepiece, each as convenient and as well adapted to its proper uses as if separate," and the two together as "forming a piece of apparatus both useful and ornamental, and a desideratum alike in the school room, office, and family."

He then calls special attention to "the excellent time movement, durable, powerful, easily wound and regulated, and of thorough workmanship throughout."

Next he notices the obvious fact that "all parts of the mounting are rigid and strong, yet light, and the whole at once firm, stable, elegant, and convenient, the entire globe surface being exposed to view, and the plate glass clock dial sufficiently conspicuous without cutting off a view of the globe or the globe of it."

And also that "the placing of the time movement inside of the globe, while it is conveniently wound and regulated from without, insures its

[1] Mr. Dickinson's paper has not been furnished for publication.

place on the eastern continent and announced to us on the western, as is frequently done, before their apparent real date, is readily comprehended by the help of this microcosmic exhibition of the daily phenomena.

(5) Another useful result for educational purposes, following from the peculiar construction of the time globe, is the great simplification it offers of the problem of converting difference in time into difference in longitude, and vice versa.

The universal dial being also a great circle, its time divisions bear fixed relations to its circular divisions, every fourth one of its 1,440 minute divisions coinciding with each degree mark, and, of course, every hour division with every fifteenth degree mark. The difference in longitudinal distance, therefore, between any two places, may be read off indifferently either in time or in longitudinal notation.

(6) By reason of its continual movement the time globe illustrates with great simplicity another difficult matter for the pupil to comprehend, viz, the change of date.

Having called attention to the fact that the maritime powers of the world have agreed to regard the 180th degree of longitude from Greenwich as introducing each commercial day by its passage under the midnight meridian of the celestial sphere, it will only be necessary to fix the fact in the mind of the pupil that this 180th terrestrial meridian leads on each new day; that, consequently, at the moment of coincidence there is but one commercial day on the earth, while at every other moment of the 24 hours there are parts of two days on the earth—one day in progress, and measured by all that part of the earth's surface included between the midnight meridian and the 180th terrestrial meridian, in the direction of the earth's motion, and the other the previous day, diminishing, and covering all the rest of the earth.

In this connection we beg leave to call attention to the ease with which the illustration may be conveyed of the cause of the long twilights in the vicinity of the poles, and of the comparatively sudden transitions between light and darkness on or near the equator. The increasing rapidity of the earth's motion from the poles to the equator is represented to the eye by the enlarging angle between any two meridians.

And, finally, the value of this piece as an apparatus for illustrating by object teaching the passage of the earth around the sun in the plane of the ecliptic, may be seen from the fact that, when standing in position through the year, the equinoctial and solstitial phenomena are accurately reproduced on its surface, as also the phenomenon of the unequal duration of the days and nights from one equinox to the other. At the time of the summer solstice the sun, standing over the Tropic of Cancer, will be observed to reach with its rays beyond the north pole to the Arctic Circle. Thence it will gradually approach the plane of the equator, pass it at the autumnal equinox, and proceed on its course until, at the winter solstice, standing over the Tropic of Capricorn, it embraces the south pole in its light, reaching beyond with its rays to

the Antarctic Circle, from whence these phenomena will be repeated in reversed order.

The great need of any additional simplification of the principles of geography by object illustration has been sorely felt by every conscientious teacher of this science. While in its descriptive parts geography is readily mastered, there is, perhaps, no science taught in our common schools which in its principles, especially those bearing upon its astronomical relations, is less understood; the usual computations in a common almanac of the results following upon the earth's motion, such as the ever changing hours of sunrise, sunset, the equinoxes and solstices, being to the great mass as cabalistic as the signs of the zodiac.

The importance of the time globe achievement—"following upon a multitude of failures"—as wonderfully simplifying the principles of practical geography, may not only be gathered from the eminent names of those who have so warmly indorsed it, but will be obvious to every teacher upon examination of the instrument.

(For a representation of the time globe, see last page of this circular.)

TECHNICAL EDUCATION IN ITS RELATIONS TO ELEMENTARY SCHOOLS.

Dr. J. D. PHILBRICK, of Massachusetts, then read the following paper:

Education of every kind and degree is comprised in two great classes:

(1) General education, which includes in its scope at once the body, the intellect, and the heart. It strengthens, develops, and elevates the individual, and prepares for society vigorous, enlightened, and honest men; in the terse phrase of John Stuart Mill, "it makes capable and cultivated men."

(2) Technical education, which is designed to qualify persons for the exercise of a profession or trade. Its aim is to fit men for some special mode of gaining their livelihood. In its highest grades it is concerned with those professions which are called liberal; it forms in its lower stage the artisan or craftsman.

Both these kinds of education are indispensable, and where there is a lack of either there is imperfection and perhaps danger. The educational system of a country should, therefore, correspond to this division, and it will be complete or incomplete in proportion as it accomplishes the objects, for each individual, of both general and technical education.

Nothing is more striking in the educational movements in the most advanced nations than what has been done in recent years, and is now doing, by governments, municipalities, industrial organizations, and private enterprise, to provide the means of technical education of every grade and description. This is done with the twofold view, first, to promote the well being of the individual, to render every man, however humble his condition, not only self-supporting, but comfortable and prosperous; second, to promote the general interests of productive industry, and to meet the increasing demands for higher professional skill which the progress of civilization creates.

In our own country technical education is as yet but very imperfectly developed, especially in its industrial department. To be convinced of this, one has only to compare the provisions for the instruction of youth and adults in the arts and trades in our oldest and largest cities with those of Paris, Berlin, Vienna, and London.

For a few years past the problem in technical education which has especially occupied public attention in this country has been the relation of the public school with skilled labor and manual employments. The complaint is made that the schools of the present day tend to unfit the pupils for gaining their livelihood by manual labor, for which the large majority are inevitably destined.

No intelligent person can deny that the growth, development, and progress of our public free school system during the last quarter of a century have been little less than marvellous. Witness the vast increase of schools, of teachers, and of expenditures for educational purposes; of normal schools, of teachers' institutes and other organizations for raising the qualifications of teachers; the improvements in supervision, in schoolhouses, in text books, in courses of study, and in all the appliances of instruction; in the methods of teaching and discipline; in classification, grading, and attendance; and, finally, the multiplication and enlargement of free schools for instruction in the higher branches. In all this there is, doubtless, from the point of view of general education, reasonable ground for gratification. M. Buisson, the eminent French educator, meant it not as flattery when, in beginning his remarkable report on our system, he quoted the saying, "A republican government needs the whole power of education," and added, "These words of Montesquieu have, perhaps, never found a more striking application than in the subject which we are now about to consider."

And yet the charge is made and reiterated in various quarters that our schools of the most advanced type, where the organization is most complete, where the attendance is most prolonged and the instruction most efficient, fail in practical results: that they educate the mass of the pupils out of their sphere, and send them out into the world with a distaste for manual labor and unfitted for the life for which they are destined. The substance of the complaint is, not that the pupils are sent out uninstructed, not that they are wanting in intelligence and mental culture, but that they are graduated without possessing the practical knowledge and manual skill requisite to earn a living, and without the disposition developed to acquire such knowledge and skill.

Those who take this view of the results of the typical common school of the present day do not agree as to the modification demanded. On the one hand, there are those who advocate the reduction of the curriculum to the merest rudiments of instruction. They would throw overboard all the costly machinery of the modern school system, and return to primitive simplicity, ignorance, and contentment. On the other hand, however, the more numerous and influential class of these complainers

propose that the schools shall be made to take the place, to a certain extent, of the apprenticeship which in former times afforded an open avenue to the arts and trades, but which the modern revolution in industrial pursuits has partially broken down.

Hence has arisen the important question as to the proper adjustment of the relations of technical education to the public school, which is at present so prominently before the public mind, and which it is the purpose of this paper to consider in some of its bearings.

And, first, it is to be observed that if our system, at its best, has failed to meet in a satisfactory manner the wants of those for whom it is intended, it does not stand alone in this respect. Its scope and methods are substantially those of the best systems in the most advanced nations. The two chief points of difference are these: First, our pupils who complete the course leave school at a somewhat maturer age than do the pupils of the best foreign elementary schools, not taking into account supplementary day and evening courses which are obligatory in some countries; and, secondly, a large proportion of our pupils drop out before completing the course, which is not the case where education is practically compulsory.

Certainly the charge that our schools carry their pupils too far in general education and educate their pupils out of their sphere, is wholly groundless so far as it relates to the lamentably large percentage of the children who are withdrawn from instruction in its lower stages. What this large proportion of our children who thus prematurely terminate their schooling need is, not less general education, but more, to fit them to become good citizens.

And, further, it is to be remarked that those pupils who, at a more mature age, complete the course of instruction provided in our most advanced elementary schools are the élite, coming largely from families in measurably easy circumstances. The parents of these children are justified in giving them an educational preparation for careers not requiring apprenticeship to manual trades.

It must be remembered also that the present outcry against the over intellectual education of the children of the masses of the working population is no new thing. It is as old as the existence of common schools for the children of the people. It has been heard in every country whenever a movement has been made for enlarging the scope of popular education. It is essentially the protest of the aristocratic class against the inevitable advance of democracy and social equality. In practically opposing liberal provisions for the education of the people, the aristocratic class always allies itself with and leads the most ignorant and illiterate portion of the community. Or, as it has been aptly said, it is the froth and dregs of society that unite, at all times and in all countries, in opposing the provision of good schools for the people. History makes it clear that it is to the great intelligent middle class

that we must look for the defence and support of a liberal system of popular education.

Nevertheless it is not to be denied that there are intelligent and earnest friends of popular education who desire that the common schools should be made more practical; that is, better adapted to prepare their pupils for gaining their livelihood. For the accomplishment of this purpose the plan has been proposed and advocated, in some quarters, of introducing into the common schools instruction and exercises in manual arts and trades, or, as it has been called, the placing of the workshop in the school, thereby making the school serve the purpose of an apprenticeship.

This plan is advocated on these four grounds:

(1) That a complete education for practical life requires that the training of the hand should be carried on simultaneously with the acquisition of knowledge and mental culture.

(2) That the appropriation of a considerable portion of the pupil's time to hand labor will not retard his intellectual progress.

(3) That it will develop the taste for manual labor and prepare the pupils for earning their living on leaving school.

(4) That it would be a benefit to the community by supplying the industries with a better class of workers.

It will be seen that the question involved in this plan is twofold—pedagogical and industrial. On its industrial side it is essentially the problem of apprenticeship, one of the chief aims of the plan being to teach the pupils a trade, since, as it is alleged, in consequence of the breaking down of the ancient system of apprenticeship, boys have no longer the chance to acquire a practical knowledge of skilled handicraft in workshops under patrons and masters. On the pedagogical side, the question in substance is, whether the placing of the workshop in the school will defeat the just purposes of the general elementary education.

We find the germ of the idea of introducing manual labor into the school in the Émile of Rousseau, who included in his plan of education for his model pupil apprenticeship to a trade. But Rousseau did not touch upon the practical question of organizing instruction in handicrafts in public schools with which we are dealing. His pupil belonged to the independent class, and went to no school; his instruction was wholly individual, his intellectual studies being pursued with a private master, while his training in manual labor was received in the workshop of a joiner.

Still the question was soon raised by his countrymen, whether it is necessary in schools to teach trades to the children of the people. And in a remarkable work on the education of the people, published nearly a century ago, the following points, in substance, were made in opposition to the project:

(1) If the same trade were taught to all, it would do injustice to the

natural aptitude and taste of the pupils; it would do injustice to the parents, who ought to have a voice in determining the career of their children; and it would contravene the true end of the common school, namely, to render the pupils fit for all the trades and occupations which belong to this class of citizens.

(2) If, on the other hand, it is proposed to teach different trades so as to afford a choice, how can this be done without infinitely multiplying the cost of the school, from the necessity of multiplying the number of masters? And, besides, for what trade is the boy under twelve or fourteen years physically suited?

(3) The essential thing is, not that the boy on going out of school should know a trade, but that he should be fit, mentally and physically, to begin apprenticeship to any one he may choose. If he is well educated he can easily learn the trade he likes.

These reasons, as conclusive now as then, have not availed to silence discussion of the subject or to prevent the plan from being put to a practical test.

It is especially in France that this matter has been and is now agitated. To meet the difficulty which the teaching of trades in school presents in consequence of the variety of industries, each requiring a master, its advocates classed the manual operations of the principal trades in three or four categories, and thus arrived at what they called the synthesis of the work of the shop, represented by the bench, the lathe, the vise, and the anvil. They found that in the practice of the trades the general processes used in fashioning the materials are nearly the same. It was held that by learning these processes and acquiring skill in the use of tools the pupils would acquire a valuable knowledge of the trades of the workers in wood, ivory, iron, and steel. For the purpose of this instruction, comparatively few shops and masters would be required.

In accordance with this theory, schools were established many years ago, under the auspices of the minister of public instruction, in different parts of the country, to serve as models for the regions in which they were located. These schools have disappeared, some without leaving any trace and others by a change in purpose and organization.

More recently the experiment has been renewed in Paris, under different and very favorable auspices, some account of which has already been published in this country. The experiment to which I refer was begun seven years ago, in connection with an elementary city school for boys in Tournefort street. For this purpose the school was provided with four additional rooms, one for modelling and carving, one for instruction in what is called technology, one for wood work, furnished with benches and a lathe, and one for iron work, furnished with vises and a forge. The technology room is in reality a class room, combined with a museum of raw materials, typical specimens of work representing the general processes of the trades already alluded to, and a variety of tools. Here oral lessons on these matters are given to the technical classes

on the object teaching plan. Boys are not admitted to the technical department under eleven years of age. The course is three years. In the first year all the members of the class pursue the same course of manual exercises. Afterwards some optional specialization is allowed.

The general education, with modifications in the direction of technical instruction, is continued concurrently with the exercises in the workshops. Each year the pupils, like those of the other city public schools, participate in the examination for the certificate of graduation in the regular school course with satisfactory success.

The favorable results of this experiment led to an attempt to secure the passage of a law providing for the general establishment of similar schools. It failed, however, to get much support, because the wisest and most influential educational authorities (among whom was M. Gréard, the eminent director of the city school system) were of the opinion that the satisfactory results of this experimental school were due to an exceptional concurrence of favorable circumstances, and that, under ordinary conditions, the inevitable outcome must be a poor workshop and a poor school.

Without doubt the best pedagogical authority is everywhere overwhelmingly opposed to the idea of annexing the workshop to the common school and in favor of insisting on a sound and thorough general education as the most useful and the most truly practical preparation for life. If it is attempted to carry on two kinds of education simultaneously and side by side, one of them will be sure to suffer.

The age for terminating general elementary education may be fixed too high. I am inclined to think that the age of fifteen is too high. But having determined the period for elementary schooling, it should be strictly consecrated to those studies which are calculated to form capable and sensible men and women, no part of it being surrendered to a manual apprenticeship. This reasonable minimum of school education should be guaranteed to the children of the laboring classes no less than to the children of the well-to-do and of the rich.

But what of the half time system? Is it not claimed that pupils will learn as much by dividing the school time half and half between manual labor and study as they will by giving the whole of their time to study? This theory has some advocates. It originated in England. It has not, however, met with favor to any considerable extent among sound and experienced educators. It is an absurdity. A half cannot be equal to a whole in instruction any more than in the science of quantity. No doubt half the time in a good school might be of more worth than the whole time in a poor school. Moreover, if school hours are made too long by half, then a half would be better than the whole for study? But the half time system, which daily takes from the pupil half the normal hours of study and tuition, is at best a mere makeshift. It is doubtless a great deal better than no schooling, but to regard it as an adequate substitute for the whole time system is a delusion.

But taking as our definition of education the preparation for life, is it not possible to render our common schools of the best type more effective for this end? I think it is, and in this way:

(1) By reducing the time devoted to what are called the old studies: reading, spelling, writing, arithmetic, geography, and grammar; by lopping off all superfluities in the treatment of these subjects, by the use of good methods, reënforced by a good organization, the pupils may be well up in them at the age of twelve years.

(2) By introducing more of the new studies which lie at the base of all technical education, namely, drawing, geometry, physics, chemistry, natural history, and applied mathematics. These subjects are, of course, to be treated in an elementary and practical manner. Politics, morals, and gymnastics are also to be included in the curriculum.

But perhaps the greatest thing that can be done in the common school to promote technical education is properly to ground all pupils of both sexes in drawing, both geometrical and freehand. There is no other branch of instruction that belongs so entirely both to general and technical education. It affords the training of the eye and hand universally requisite, and especially necessary to the skilled workman. And yet, so great is the prevailing ignorance on the subject even among the more intelligent classes of the community, that drawing in the public schools is very generally regarded as a superfluity, and is stigmatized as a mere accomplishment, an ornamental branch, a fancy study—an absurd contrivance for converting all children into bad artists. The most practical study of all is denounced as a hindrance and a stumbling block to practical education. This popular prejudice against drawing shows how far we are from being prepared to take the first effective step towards providing a well organized system of national technical education. That first necessary step is to make the teaching of drawing obligatory in all common schools, and to provide for its efficiency by the establishment of a sufficient number of normal art schools for the training of competent teachers and directors of drawing not only in its elementary but also in its higher grades.

In visiting the experimental school in Tournefort street, Paris, to which I have referred, I was much struck by two of its appendages, which it seemed to me might be profitably connected with common schools where the means would permit the expense which the providing of them would involve, namely, the room for modelling and carving and the room for technology. The technological instruction given in the latter might fairly be accepted as coming within the scope of general education, while at the same time it is a most useful element of industrial education. This instruction is the application of the intuitive method to the most practical use imaginable. I see no reason why every school might not, could not, or should not have its little technological museum. And modelling and carving in wood, soft stone, ivory, &c., afford admirable training for the hand and eye, as well as a means of

cultivating the taste. To the work in this shop the strength of pupils of school age is quite adequate.

The instruction which I have called technological belongs rather to boys' trades than to girls'. In every school where there are girls there should be a department for the technology more appropriate for girls. Here should be provided instruction in sewing, cutting out and making, and in ornamental work to a greater or less degree. Man must learn to make himself useful in innumerable occupations and trades. The normal trade of woman is household administration. Hence the general and technical education appropriate for woman more nearly covers the same ground than in the case of man. And hence, there ought to be a considerable difference between the elementary education of boys and girls.

The public school conducted in accordance with these views would, in my judgment, furnish a better preparation for life in the civilization of the present day than would be afforded on the one hand by an education more exclusively literary or on the other by a combination of intellectual instruction with the learning of manual trades.

Special schools for special functions is the law of educational progress. It is the industrial school, therefore, and not the common school, that must furnish the requisite special training for the exercise of the industrial arts and trades, so far as such training is furnished otherwise than by apprenticeship.

In all ancient times apprenticeship was the one mode of initiation into the mysteries of all professions, arts, and trades. It is a characteristic of modern civilization that the special school comes in more and more to supplement or replace apprenticeship.

What is practicable in this direction for boys on leaving the common school is, perhaps, best illustrated by the Municipal School of Apprentices in the boulevard de la Villette, in Paris, which was opened in December of 1872.

The aim of this school is the same as that of the Tournefort street school, namely, to initiate boys into certain industries of iron and wood. But here the technical education succeeds the general education, instead of accompanying it. This establishment is not a school with a workshop placed in it or appended to it, as is the case with the experimental establishment in Tournefort street; but it is a workshop, or a system of workshops, with a school appended.

The principles upon which this institution is organized are, in abridged form, these:

(1) No premature admissions.
(2) No massing of large numbers of pupils.
(3) No hasty specialization of exercises.
(4) No payment for tuition to be required.
(5) No instruction properly called scientific.
(6) No applications outside of the ordinary constructions.

These principles are thus embodied in the regulations:

The maximum number of pupils is 150.

Candidates must be at least thirteen years of age, and furnished with a certificate of graduation from the common school, or must pass an equivalent examination.

The duration of the course is three years.

The pupils are divided into three sections, corresponding with the three grades of advancement.

The instruction is general and technical.

The general instruction comprises the obligatory studies of the elementary school and some of the optional branches, such as the elements of physics, of mechanics, and chemistry in their relations to the industries. With it is joined the technological instruction referred to in the account of the school in Tournefort street.

The technical instruction is, first, that of preparation, and, secondly, that of execution. In the preparatory course of the first year each pupil in rotation passes through the shops of wood and iron, performing a succession of certain elementary exercises. In this preparatory course each pupil in the class has charge of the engine for a certain number of days. The work of execution begins with the second year, when the choice of a specialty is permitted.

Besides the shops for work in wood and iron, there is a department of precision into which pupils of exceptional talent are admitted.

The pupils remain within the walls of the establishment from 7 in the morning until 7 in the evening, one hour, from 11 to 12, and half an hour, from 2½ to 3, being allowed for dinner, lunch, and recreation.

This school was not established in a haphazard manner, but on a plan thoroughly matured by Mr. Director Gréard, after a profound and exhaustive study of the subject, the results of which he embodied in a remarkable memoir, which was published in 1872 and was embraced in the French exhibition of education at the Vienna Exposition. It began with a complete organization and all the needed equipments. It has been in all respects successful. It meets a real want and accomplishes its purpose. It is without doubt the model school of its class of the whole world. The schools of apprentices of Havre and Amsterdam perhaps rank next to this.

This type of technical schools is wholly wanting in this country. The excellent Free Institute at Worcester, Mass., in its shop department, has, perhaps, the nearest resemblance to it; but in its theoretical department it is of a much higher order; it is designed to form engineers and industrial superintendents, while the Paris school has for its special function to form skilled workmen.

The school of mechanic arts connected with the Massachusetts Institute of Technology is an experiment in the same direction; but here the pupils stop with exercises in "*in*struction" and do not proceed to those of "*con*struction."

Next to the placing of drawing on the proper basis as a branch of instruction in all our public schools, what I most desire to see at the present moment, in connection with the organization and development of elementary technical education, is the establishment in our principal cities of duplicates of the Paris School of Apprentices.

RÉSUMÉ.

(1) Education is a preparation for life.

(2) Education is of two kinds: general education, which forms capable and honest men and women, and technical education, which fits men and women for some profession or trade by means of which they can gain their livelihood.

(3) The common school is for the first stage of general education and particularly for the mass of children who are not destined to a higher stage of general culture.

(4) The common school receives its pupils at six years of age, retains them eight years, and dismisses them at fourteen years of age.

(5) Useful technical education in a course side by side with the general education of the common school has been proved to be possible but not generally practicable, and such a combination as a system is not approved.

(6) The common school should be strictly held to exclusively general education, and this will be best when it forms the best basis for the technical education of the apprentice which should follow it.

(7) The common school should not attempt to teach what is called the old curriculum of studies scientifically or exhaustively, but for practical ends; and thus time will be gained for teaching in the same practical manner drawing, the elements of geometry, physics, chemistry, natural history, and applied mathematics.

(8) Girls should be taught in the common school the elements of household economy, and especially sewing, cutting out, and fitting, and boys, where the circumstances permit, modelling, carving, and technology.

(9) It would be well for country schools to have a garden attached, and for all boys' schools to have a room for special uses containing a bench, a vise, a lathe, and a few of the most common tools.

(10) Schools of apprentices should be established in great variety for boys and girls who have completed the common school education.

(11) The school of the apprentice is not a substitute for apprenticeship, but it affords the best initiation into handicrafts. Its primary aim is to form the skilled workman; it supplements manual exercises with general and special instruction.

(12) Model schools of apprentices should be established at the public expense; but, in the main, they must be established and maintained by industrial establishments and organizations.

(13) The Municipal School of Apprentices of Paris is recommended

as the best model of a school of apprentices supported at the public expense.

(14) The school of apprentices connected with the great printing house of Messrs. Chaix & Co., in Paris, is recommended as a model school of the type supported by a private establishment.

Mr. J. O. WILSON, president of the National Education Association, announced that its next meeting would be held in Chautauqua, N. Y., on the 13th of July next, and would continue its sessions for four days.

Prof. I. N. CARLETON, president of the American Institute of Instruction, announced that the next meeting of that body would be held in Saratoga, N. Y., commencing on the 6th of July next.

Mrs. LOUISE POLLOCK, principal of the Kindergarten Normal Institute of Washington, D. C., made a few remarks on the benefits the primary school teacher would derive from a thorough Kindergarten training. She extended an invitation to every State of the Union to send one lady well qualified by disposition and education to receive the Kindergarten normal training free of charge in the Kindergarten Normal Institute of Washington.

The first year of eight months she is to go through the regular course of instruction, the same as is done by the other ladies who pay for their tuition; and the second year she is to gain practical experience of teaching under the supervision of Mrs. Pollock and daughter.

The three points made were:

(1) Teachers in our public schools who have gained a good insight into the merits of the Kindergarten system will know better how to make all knowledge more practical and interesting, and they will avoid the danger of getting into ruts or of looking upon teaching as a drudgery or simply as a means for earning money. They will find that its principles of learning through doing (the intellectual part of the Kindergarten philosophy) can be carried up to the higher grades, without loss of time from elementary instruction, as can be proven both in the National Kindergarten and in the Kindergarten and school of Miss Susie Pollock, where children from six to eight years of age have gained as much book knowledge in two hours a day, with one hour devoted to Kindergarten exercises and occupations, as other children, with three or more hours devoted to elementary studies exclusively.

(2) Many children have to leave school early to assist their parents in earning money as cash boys, &c. It would be a great gain to them to enjoy two years' (when from four to six years of age) attendance in a Kindergarten. Mr. McRae, of Indiana, expresses the opinion that he values one year for his child in a good Kindergarten more than two years in an industrial school afterwards.

(3) As the attendance in our primary schools is a great deal larger than in any other grade, they should receive the most attention. Our normal

schools should make it a point to give the primary school teacher the best possible preparation, including the Kindergarten normal training.

Teachers thus prepared should be encouraged to remain in the lower grades, by paying them as good a salary as the teachers of the third or fourth grade receive.

President NEWELL asked that time might be given Dr. Philbrick to explain what he meant by and included in the term "technological museum;" whereupon Dr. PHILBRICK made the following statement:

TECHNOLOGICAL MUSEUMS.

In speaking as I did in my paper of the great utility of technological museums, I used the term in its more comprehensive signification, as comprising not only such museums as are usually found in Europe in connection with the superior institutions for instruction in applied science, namely, schools of mines, of forestry, of agronomics, of mechanics, of engineering, and of building and architecture, but as embracing, also, special museums connected with manufacturing establishments, of which the museum at the national manufactory of Sèvres is one of the most remarkable examples; and, finally, I meant to include under the term industrial museums, whether national or local, those which are of the nature of permanent exhibitions of natural products, apparatus, tools, and machines, and specimens of manufactured products, both useful and ornamental. The museum of the Conservatoire des Arts et Métiers, in Paris, is perhaps the most complete and comprehensive type of the technological museum, while the little collection in the Tournefort school, which struck me as a desirable thing for boys' schools generally, may be regarded as the most rudimental specimen. One is at the top, and the other is at the bottom of the scale; but they both belong to the same category and are equally useful in their respective limits.

The world's exposition is in reality but a universal temporary museum of technology, and the enormous multiplication and growth of museums illustrating the practical arts and the decorative arts, or arts of industrial design, as well, during the last quarter of a century, are due in no small degree to the stimulus and the materials afforded by the several universal expositions which have been held.

These museums are schools for the application of the intuitive method of instruction to the people generally, in educating them in matters of practical utility connected with their interests in a thousand ways.

In our own country such museums as are here referred to are as yet to be created; but it is easy to see that our Centennial Exhibition has imparted a decided impulse in the direction of their creation, and I trust the time is not distant when they will be spread all over the country.

One of the best sayings of Agassiz was that he hoped the time would come when every primary school would have its little museum of natural history. May we not hope that every common school may, in due time, be furnished with a little technological museum? In one of the fine

common schools of Vienna I saw installed in a good sized room a beautiful combination of a museum of technology and of natural history, with a pedagogical library for the teachers and a juvenile library for the pupils, and a set of physical apparatus. For the purposes of popular education all sorts of museums are needed. Every village should have its public museum as well as its public library. The museum is only second to the library as a means of popular education. The village or town museum would naturally comprise the elements of all sorts of museums. Specialization would, of course, be carried out in larger towns in proportion to the size and resources of the community. The national capital should have not one museum only, but a comprehensive series of museums, organized on a scale worthy of a great and wealthy nation.

A school museum of technology might be easily begun by a collection of metals in various forms and of woods in different stages of manufacture. A beginning once made and a place of instalment secured, the thing is sure to grow in size and interest and usefulness.

Dr. W. T. HARRIS, of St. Louis, then read the following paper, which was commented on by Messrs. Eaton, Ruffner, and Wickersham:

THE TENTH CENSUS FROM AN EDUCATIONAL POINT OF VIEW.

PART I.—GENERAL CONSIDERATIONS.

The importance of statistics in regard to man as a social being has been appreciated ever since civilization began. Man as a social being and man as an individual, particular person, are two very different objects. As individual, John or James, each has a self—an ego—but a self hemmed in by limitations qualitative and quantitative. As existing in the organic form of institutions, man becomes a series of giant selves, each one formed in the general image of man and having its head, its hands—its deliberative power, its will power to execute with. As such vast organism, man becomes infinite in respect to many points wherein the single individual is finite. For example, the single individual exists here and now in a single definite place and moment of time. He is limited in respect to size and weight, strength, hunger and thirst, ability to sustain heat and cold, youth or age, sex, health or disease, education, climate and season, conditions of weariness or vigor, and such matters. As individual he is a very uncertain element. But by combining into social organisms he so reënforces his finite self as a particular bodily and mental self that he wellnigh removes these limitations of time and space, and as a civilized being he becomes something general whose limitations are cancelled or annulled through participation, each man participating in the life of all men.

In the most rudimentary of those greater selves—the family—the inequalities of infancy, youth, maturity, and old age are mediated and balanced, so that the infant lives a rational life in full view of his destiny;

the feebleness of old age is provided for; the sick are cared for by the well; the inequalities of sex are compensated, and likewise those of industrial capacity.

In social economy as the department of productive industry, the finitude of the individual as lacking skill and adaptation to all trades and wants is annulled by the division of labor, and each one is allowed to develop the maximum of skill by limiting himself to the minimum of variety in the use of his brain and muscles.

In the state we find still greater results achieved. While the individual little man (the microcosm) is periodic in his variations, needing alternations of work, rest, recreation, and sleep, being unable to think or to work at certain times, the nation never sleeps, never ceases to wake, to think, to act, to provide, to produce. During the sleep of one individual the nation watches through the person of another individual; it pieces out the defective thinking and planning of each individual by means of the thinking and planning of a large organization of men; it strengthens the backbone of one man through the addition of many others. It adjusts itself everywhere by eliminating the defects of excess or deficiency in one individual by results of combination, wherein each individual's work is modified through that of others, and thus a general more rational result is attained.

It is not necessary to speak of the institution of the church, by which the consensus of the highest thinking and feeling of the human race in regard to spiritual matters is obtained, and by means of education made to be the conviction of all people in the community. In general, it is the province of institutions — the family, civil society, the state, the church — to make real the ideal self of man as an infinite, self-determining being, i. e., a free being, and to make available the results of this higher being, this synthesis of small beings in a greater, to each and all, so that each individual may participate in the life of the whole, and share not only in the food, clothing, and shelter produced by all human industry, but also share in the realized intelligence of all men on the globe in our time; more than this, to share in the wisdom of the race collected and preserved without loss or diminution from generation to generation.

It is clear from this point of view that the problem of life from a human point of view is this one of "How shall the individual come into this realm of participation so that he may share in the total production of his fellowmen, material and spiritual production?" The microcosm must become the macrocosm. The means for this and the application of those means make up education as a life occupation. There must be no arrested development anywhere. All life is education: the nurture of the child, the school epoch for the youth, the business vocation of early mature manhood, the citizenship of mature life, the church as the continuous spiritual culture of the individual up to insight into the eternal verities — all these are one process of education, and the school is only a small department of the whole of human education.

In view of this difference between the mere individual man as the possibility and the realization of man by means of institutions wherein individual combines with individual and many make one (as hinted in our national legend "E pluribus unum"), each one sinking his selfish, egotistic independence in order through his dependence on the social whole to participate in and realize a higher, broader independence—in view of this relation of the multiplicity of individuals to the realization of the rational life of each, we behold the interest of statistics. It is not each individual by himself, but each for all and all for each. The quantitative element in the human organization has great qualitative significance. Quantity in the army may mean freedom or subjugation and slavery; in the productive industry it may mean wealth and luxury or poverty and starvation.

While looking upon this general question of numerical relation as important for the existence of man as a civilized, rational being, we also see the several aspects which statistics have. In general it is the characteristic of man to be self knowing — a conscious animal. From his knowing, his intellect, he obtains the laws and principles with which to direct the volitions of his will; directive power comes with self-knowledge. And again the most important part of self-knowledge is this knowledge of man's greater self—the social self. Self-knowledge therefore includes as first and most essential the knowledge of institutions. The state must have knowledge of the quantitative phases of its reality; social science must know the general trend or aggregate result of its minor processes—judging of its labor system by the paupers it casts ashore, its local suffering and want, the balance of its exports and imports, the means of equalizing vocations, &c., and of its condition of family nurture by the number of unfortunates produced, the deaf and dumb, insane, idiotic, blind, the orphans, its statistics of crime, &c.

In the order of these species of self-knowledge we must not omit to note as important the distinction between what is essential to direct self-preservation and what is secondary, i. e., essential to preservation, but only mediately so.

It will be found that the political necessity—the necessity of the state—is always the first and most direct one. Without the state the social elements are all exposed under the cruel open sky, and doomed to destruction by the inclemency of the storms that rage there. The roof of the state must first be raised before the other social elements can exist or be perfected. Life and property are the first essentials; when these are provided for, then comes the third element: social condition. As the nation progresses into freedom it comes more and more to recognize the secondary elements as essential, and to recognize their reaction upon the political power of the state.

What a lesson has been taught in Europe in recent times of the importance of an educated people to a strong state. Prussia has made it

impossible for statesmen to neglect public education if they expect to preserve independent nations on the continent of Europe.

Without occupying you further with these general points of view I will now take up the special theme assigned to me for consideration, and will therefore ask your attention to a suggestion in regard to a slight modification of our census tables with a view to enabling school officers throughout the United States to study the question of school population in a more satisfactory manner than they have been able to do hitherto.

PART II.—SUGGESTED CHANGES IN THE SCHEDULES OF THE UNITED STATES CENSUS.

The technical expression "school population" refers to the definitions given in the several State constitutions of the part of the entire population that shall share in the annual distribution of the proceeds of the State school fund. The period usually fixed upon for school age begins at 5 years of age or at 6 years (in 16 States at 5, and in 16 at 6 years), and ends at 20 or 21 years (in 20 States at 21, and in 7 States at 20 years).

The "school age" is important in determining the ratio of children who *ought* to be in school to those who are *actually* in school, and consequently it is essential to determine the importance of measures to be taken to extend the school system.

The census of the United States for 1870 did not give the data from which to ascertain the number of the population between the ages of 6 and 20 or 21.

While the returns from the special localities gave the ages of all people, the abstract which was printed by the Census Bureau gave only the following summaries: Under 1 year of age; 1 year and under 2 years; aggregate under 2 years; 2 years and under 3; aggregate under 3 years; 3 years and under 4; aggregate under 4; 4 years and under 5; aggregate under 5. All is satisfactory thus far, but now on we have only the aggregate population between the ages of 5 and 10, 10 and 15, 15 and 18, 18 and 20, 20 and under 21, with aggregates of population under 10, under 15, under 18, under 20, under 21, under 25, under 30 &c.; after 80 the population is given for each year.

By subtracting the number of people 4 years and under from the total under 21, it was possible to tell how many were between the ages of 5, and 21; but only an approximate estimate could be arrived at as to the number over 6 and under 21, or any other age, for the reason that the number under 6 is not given.

The addition of only three columns, showing respectively the number at the age of 5, 6, and 7, would give us the data from which to calculate exactly the school population in thirty-five of the States; and if the number aged 16 were given, we could calculate this item in all the States.

To make this addition, and at the same time to avoid increasing the size of the tables, the columns of aggregates could be omitted, aggre-

gates being easily obtained for the total under 2, under 3, under 4, under 5, by adding the items given for the previous periods already. We need the data far more than the summaries, which are elaborated merely for convenience.

If we could have the tables so full as to give us the number at each age from 1 to 21, the service in the cause of education would be still greater and the service to general social science would be quite invaluable.

On the part of school education we could ascertain just what ratio of the entire population we enrolled in school at the several ages, at 7, at 10, at 14 years, for example, and it would give the definite data to determine in what periods of life the greatest withdrawal from school takes place and where it is necessary to put the chief stress of the system. Should we endeavor to increase the attendance upon school of pupils at the ages of 6 or 7, or at the ages of 14 or 15; should we adopt the device of the Kindergarten, or should we give more attention to the attractiveness of the grammar schools or high schools?

In general social science a great field of study would be open at once. If you cut down a tree in the forest and study carefully the rings of annual growth in the wood, you will see there the record of the climate and seasons of each year as it affected the growth of that tree, the degree of moisture and dryness, cold and heat, &c. This could not be done if you neglected to study the single rings of annual growth, but lumped the results into periods of five years. Each aggregate equalizes and cancels individual differences of seasons, just as the social aggregates equalize and cancel the idiosyncrasies of the individuals. A year is a cycle of growth in the vegetable kingdom and to a less degree also in the animal kingdom. Five years is no natural period of growth and decay, and its meaning as an epoch is very slight in human life.

In the first twenty years of human life, if we could have the statistics by years, we could study the effects of perturbations in the past. We could see what effect the war had made; what effect a local epidemic, a pestilence, a period of hard times, a fever for migration, &c.

Well marked epochs in human life are the following: Infancy, from birth to the age of 3 years, the child having become able to take solid food and learned how to walk; childhood, from the age of 3 to the period of its second set of teeth, 5 or 6 years; boyhood and girlhood, from 6 to 14, puberty; youth, 14 to 21, completion of bodily growth. (Of course these names, infancy, childhood, youth, &c., are used somewhat arbitrarily.)

I hesitate to urge the publication in our census report of so much tabulation as would be involved in giving for each locality the details of the ages of population for the first twenty years. And yet one would be willing to forego all the advantage of the convenience in having so many aggregates made for him. By the interested party the labor of making summaries for himself would be cheerfully undertaken if he

could get at the items readily. There are twenty-three or more of these aggregates given in the census, and all but three might be dispensed with.

In conclusion, I would say that in this paper, while I have endeavored to show how the census can be made more useful to that large class of persons who have to study it—the school directors (perhaps a more numerous class than all others combined, of the classes who consult the census)—I am far from intending to cast reflection upon the Census Bureau. Indeed I cannot close this paper without expressing the admiration which we all feel at the great progress that the successive censuses have made over the preceding ones.

One needs only to look carefully into the three volumes of the census as prepared under the supervision of General Francis A. Walker to see evidence of the great reforms and improvements that have been introduced into the schedules and into the methods of collecting information. The census for 1860 omitted the very information of most importance to the political and military power of the nation. It gave neither the voting population (from 21 upwards) nor the military strength (males from 18 to 45).

Under the present enlightened management we have had so much information added that the census has become a vast storehouse of facts for the study of our social condition, and wise statesmanship may find what it most needs for a sound basis upon which to found its measures.

A bird's-eye view of the results of the last census shows us the following important items classified under the three heads of (1) national purposes, (2) social purposes, and (3) school or educational purposes:

(1) National purposes: items of race, nativity, military age, voting age.

(2) Social purposes: items of pauperism and crime, areas and public dwellings, sex and ages by nationalities, occupations (with age, sex, and nationality), deaths (with age, sex, and nationality), diseases (with locality, &c.), unfortunates (blind, deaf and dumb, insane, idiotic), with age, sex, and nationality, months of birth of the population, wealth and public indebtedness, crops, machines, productions.

(3) Schools and education, items of illiteracy, schools and teachers, pupils, libraries, newspapers and periodicals, churches, children of school age (5–15), children attending school.

The items here separated and classified under education belong, of course, to a department of social science.

The census tables give, first, the aggregate by States and Territories; secondly, by counties; and, thirdly, by civil divisions less than counties. Tables giving the aggregates by States and Territories could be spared, if it were necessary in order to save labor at the Census Bureau.

It is not necessary to assure this body of superintendents that the census is the most valuable source of information that we possess for the study of the results of education upon society, nor is it necessary

to mention the fact that all laborers in the cause of education and social amelioration owe a great debt to the enlightened insight of the Superintendent of the Census Bureau.

The consideration of what has been suggested in this paper is respectfully submitted, in case of your approval, as a basis for a conference between the Bureau of Education and the Census Bureau.

Mr. J. M. WILSON, of the District of Columbia, put in a plea for the Industrial School of the District of Columbia. He said it was proposed to teach in this school shoemaking, gardening, sewing, cookery, and kindred work. They intended the school to be for practical work, and the rooms for each separate trade should be in themselves perfect museums to illustrate that particular trade through every step. For instance, in the room set apart for shoemaking, there you will find first the animal, then the hide undressed, then the leather, then how the leather is cut and sewed and pegged until the shoe is finished. These things are not only told the pupil, but he is instructed to do them himself. And the same idea is to be carried out in reference to other trades.

While Mr. Wilson was speaking, Dr. Barnas Sears, general agent of the Peabody education fund, entered the room, was invited to a seat on the platform, and at the close of Mr. Wilson's remarks was introduced to the audience, with a request to address them.

Dr. SEARS said that he had been unable to attend the meeting of the department earlier because the Peabody board of trustees had been in session and were considering very important matters. They had, among other things, prepared a paper for presentation to Congress favoring national aid to education, which he thought it would be hardly proper to disclose the substance of prior to its presentation to that body, and he would therefore pass from the subject with the single remark that the paper had been drawn up with much care by a member of the Peabody board of trustees and had been considered and approved by the whole board. In regard to the proper course to be pursued in administering the Peabody fund he said that at first there had been two opinions, one favoring the establishment and maintenance of separate schools, wholly under the control of their own board, and the other favoring the use of the fund under certain limitations and conditions in aid of existing schools and agencies, or such as might thereafter be established by city or State authorities, on the theory that it is wiser to help those who will help themselves. This latter opinion prevailed, and the proceeds of the fund began and have continued to be disbursed from year to year in substantial conformity to this idea, and chiefly on the advice and through the agency of city and State authorities. When he entered upon duty as general agent of the Peabody fund not one of the southern States had established a system of public schools, free to all, under State authority. He was not quite sure about Tennessee, but believed

that no common school system had been authorized or organized there at that time.

General EATON said he thought the legislature of Tennessee had enacted the necessary laws, but that they may not have been put in force at the time, 1866–'67.

Dr. SEARS, resuming, said that now every southern State has its system of free schools established by law, and he asserted that the Peabody board had contributed its full share in bringing about this result. A system of free common schools having now been provided for in all these States, his board, in common with the active supporters of these systems, were turning their attention to the ways and means of elevating the character of instruction to be given. The great want is well educated and well trained teachers, and the agencies to supply this want are teachers' institutes and normal schools.

The institutes, as cheap and immediate agencies, are well suited to the present condition and needs of the southern people, and where they are continued through several weeks, under competent teachers, they can hardly fail of excellent results. The Peabody board is now aiding to some extent these institutes, but their chief reliance was and is upon normal schools; and to their support the board are now devoting a large proportion of the annual proceeds of the Peabody fund. There are not many normal schools of a high character in the Southern States except those aided by this fund. Virginia has now two summer normal schools, one at the university and one for colored teachers at Lynchburg, and appropriates $500 annually for the institute at Hampton. North Carolina supports a six weeks' normal school for white teachers and a yearly one for colored. South Carolina has none, but sends some pupils on Peabody scholarships to Hampton. Georgia has a normal department in the University of Atlanta, and sends 19 pupils to the Normal College at Nashville. [Superintendent Orr, interrupting, said Georgia sends 20 to Nashville.] Florida also sends pupils to the Normal College at Nashville. Alabama has one for white pupils and two for colored. Mississippi has none, Louisiana has two, Arkansas two, and Texas, though late in the field, has just provided by law for two. West Virginia nominally has six, but they are neglected, while in Tennessee is the widely known Normal College, supported chiefly by the Peabody fund. It is now the purpose of the board to use the greater portion of their fund in aid of schools and agencies for the education and training of teachers in the South.

By special request, Superintendent Wilson, of Washington, had in attendance a small class of little children from one of the public schools, taught by Miss Gertie Cowling, a late graduate of the city normal school, who went through various exercises, exhibiting the working and result of normal training as it exists in the District of Columbia.

THE HIGH SCHOOL QUESTION.

Mr. GOVE, of Colorado, asked if there was any unfinished business before the meeting or any other matter that would prevent the discussion of Mr. Philbrick's paper on technical education?

Mr. NEWELL replied that there was not, that the discussion of any paper that had been read was in order; whereupon the paper on high schools by Mr. Dickinson, of Massachusetts, being called up,

Mr. RICHARDS, of Washington, said that he did not desire to be understood as underrating the high school, for as to many of the points made by Mr. Dickinson he fully agreed with that gentleman, but it could not be denied that the majority of the children of the public schools never reach the high school, and for the majority it is a burdensome taxation. He would call attention to the greater importance of the primary schools. The new departure in primary instruction was no humbug, but a right move in the right direction. He argued that the best teachers should be set to work in the primary schools, and when a better system of training is inaugurated in these lower grade schools there would be less complaint and dissatisfaction with the higher schools.

Dr. SEARS said many things have been said on this subject of high schools, and well said, but nevertheless there were some things that he wanted to say himself. A good system of free public schools was a necessity to every State government, and although it is complained of the high school that all the children of the State do not get an education there, so about the grammar schools, all are not educated there; yet that is no argument against the grammar school. The high school is a stimulant to the school below it, as the college is to the high school, and as any higher grade school is to the grade below it. There is a political reason for favoring the high schools. They occupy intermediate ground between the common school and the college; through them a larger number of pupils obtain a higher education. These pupils belong mainly to the great middle class in society, that class which stands between the extremely poor and the extremely rich and holds in check these extremes, between which exist irreconcilable war. He was afraid of no cause that was controlled by the middle classes; he was afraid of every cause not under their control. This middle class is the great conservator of peace and order. The high school is their college. It is the keystone of the arch of public schools, and if the keystone be suffered to be knocked out the system will fall, leaving nothing but pauper schools in the ruins.

Mr. WICKERSHAM, of Pennsylvania, argued with Dr. Sears that the high school was the school of the great middle class, and if we allowed it to be attacked we gave a death blow to the whole system. He believed that the friends of high schools had adopted wrong tactics in allowing themselves to be put on the defensive, when the aggressive policy would be much more effectual. If the enemies of the high school

seek its destruction, let its friends rally and demand that two shall be supported in place of one, and it will generally turn out that these enemies will be glad to compromise the matter by an ample support of one rather than run the risk of being obliged to support two. They will be very glad to let well enough alone. At any rate, such had been his own experience in his own State, where an attempt was made to strike down a high school. Its enemies now declare that they have no objection to one high school, but are only opposed to two.

General ARMSTRONG, of Hampton, Va., did not sympathize with the old lie that a little learning is a dangerous thing. He did not like to hear any one speak disparagingly of the three R's; and he could not agree that the education derived simply from arithmetic, reading, and writing was overrated. He referred in a very complimentary manner to the work done by Mr. Charles Brace in New York City.

Mr. J. W. DICKINSON, of Massachusetts, said there is much opposition to high schools because it is argued and believed by many that the State has done its duty when it supports the elementary schools, but in Massachusetts they have been fully sustained. There are forty towns in that State that voluntarily support high schools which are not obliged to by law. There are now 216 high schools and some 20,000 pupils attending them.

Mr. RICHARDS (ironically). What is the school population of Massachusetts?

Mr. DICKINSON. Something over 300,000.

Mr. RICHARDS. And how many attend your high schools?

Mr. DICKINSON. About 20,000.

General EATON was very pronounced in favor of high schools, declaring that they should be made mandatory. He quite agreed with those who had preceded him that the high school was not only useful in itself, but useful in its effect upon schools below. It was something to aim at and strive for. Who shall undertake to measure and tell the vast power it thereby wields over the whole system of common schools? He believed the high school was a great and important institution, deserving the fullest support.

The PRESIDENT here announced that the time had arrived for adjournment to call upon the President of the United States.

The meeting then adjourned to meet at 7.30 P. M. in the audience room of the church.

At 2 o'clock P. M. the members of the department, headed by President Newell and General Eaton, paid their respects to the President of the United States at the Executive Mansion.

At the same hour the public school teachers of the District, to the number of between four and five hundred, assembled in the Congregational Church and were entertained by short addresses from a few members of the department.

Mr. DICKINSON, of Massachusetts, spoke of the philosophy of teaching, showing as he went along, by examples and illustrations, how even abstract ideas may generally be brought within the apprehension of a child, and how, without such apprehension, any mere word definition must prove substantially worthless. The idea or thing itself must first be brought clearly before the mind, and then its sign or name or definition may be given. And then, holding up a piece of chalk with which he had been writing on the blackboard, he, quite unconsciously, as it appeared, fell into the rôle of the pedagogue, and gave a very attractive object lesson with the chalk as the object.

At the conclusion of Mr. Dickinson's address, Superintendent WILSON said he had heard or read not long ago of a singular phenomenon in the pedagogic world, namely: that if you look westward over the Allegheny Mountains you will discover one head towering up long before any other comes to view. That head is now before you, and he took great pleasure in introducing to the teachers of Washington, Dr. Harris, of St. Louis. On coming forward, Dr. HARRIS said, he thought Mr. Wilson had trenched somewhat on ground preoccupied by the Irishman at the Donnybrook Fair, whose rule was to hit the first head he saw; but let that pass. As superintendent, it was part of his duty to visit the schools of St. Louis from time to time, but, owing to their great number, he could only make the most hurried inspection of each; and yet he had found that he could form a pretty correct judgment of the condition and character of a school from even such hurried visits—a judgment which was seldom overruled by his assistants, who had the time, and whose duty it was, to fully inspect and examine each school. If disorder, unrest, inattention, prevail, an experienced school officer will take in the situation at a glance. It is useless to apologize. What is found once will be found again. The test is attention—not stillness, not absence of motion, but rather "the rest of infinite motion, the sleep of a spinning top"—the absorption of pupils in their work, so that the entrance of a visitor, though noticed, passes unheeded. Such attention is not easily attainable. It cannot be put on for an occasion. Its absence cannot be explained away. It is a supreme test of success.

Mr. WILSON, resuming, said they had now heard from the educational philosopher of the East and the educational organizer of the West, and midway between the two lay the educational keystone of the great common school arch. He took pleasure in introducing to their acquaintance Dr. Wickersham, of Pennsylvania.

Mr. WICKERSHAM spoke of courses of study for the public schools and specially of the place to begin. He said there was one plain rule, namely, to begin where the knowledge of the pupil ends. It follows that the place of beginning may vary in different schools and with different pupils, and must be determined in each case by the teacher. But the rule is simple; move forward with your pupils until you reach the unknown, and begin there. Do this in all branches of elementary

knowledge. It is a mistake to limit instruction to two or three branches. Does not every child turn its hand to fifty things in a day in spite of all repression you can put upon him? Nature gives this hint and you will do well to follow it. Include in your course of study the elements of all knowledge. Variety is the law of growth for childhood.

FOURTH SESSION—FRIDAY EVENING.

WASHINGTON, *February* 20, 1880.

The department reassembled and was called to order by the president at 7.30 P. M.

Mr. HAGAR, of the committee on resolutions, submitted the following; which were adopted:

Resolved, That the cordial thanks of the department are tendered to the board of education of the District for the ample accommodations; to Superintendent Wilson for the wisdom and efficiency with which he has made and carried out all needful arrangements for the work of the department; to General Eaton, United States Commissioner of Education, for his courteous and constant efforts to make the gatherings pleasant and profitable; to Mrs. Pollock for her generous offer to educate in her Normal Kindergarten School, free of charge, one pupil from each State, who shall be recommended by the superintendent of public instruction in that State; and to the proprietor of the Ebbitt House for the liberal terms on which he has entertained the members of the association.

Resolved, That the welfare of the poor and neglected children throughout the country calls for the more serious attention of educators, statesmen, and philanthropists; and, therefore, that the system of dealing with such children, so successfully established by the State of Michigan, as set forth in the paper of C. D. Randall, is worthy of the most careful consideration; that this department respectfully but most earnestly urges upon the attention of Congress the importance and necessity of providing, with a liberal hand, for the educational wants of this District, so that all parts of the District may be furnished with suitable school buildings, with the best of school appliances, and with a sufficient number of competent teachers, to the end that all its schools may justly serve the country as models of what the best schools ought to be; that the whole department rejoices in the rapidly growing interest in popular education manifested in nearly all parts of the land; it would unceasingly endeavor to impress upon the minds of all lovers of their country the vast importance of securing as speedily as possible to every child the blessings of a generous education.

Mr. RUFFNER, of the committee on national legislation, reported the following resolution:

Resolved, That there is immediate and pressing need of Federal aid in the States, and especially to the Southern States, in the work of educating the people in the primary branches of knowledge; that the Congress now in session be, and hereby is, respectfully urged to consider and act favorably upon the bill now before it (H. R. 334) entitled "A bill to apply the proceeds of sales of public lands to the education of the people," &c., or some modification thereof which would recognize the principle of applying these funds wholly for the general education of the people; that the president of this body be requested to communicate these resolutions to the House of Representatives through the chairman of the Committee on Education and Labor, and to the Senate through the chairman of the corresponding committee.

Dr. RUFFNER then addressed the department in support of his resolution, as follows:

CONGRESS AND THE EDUCATION OF THE PEOPLE.

The call upon Congress for aid in educating the people will not cease until aid be granted. A notable reënforcement has just entered the field, namely, the trustees of the Peabody education fund, a body singularly dignified. As a body, it is well informed as to the condition of the country, and particularly of the southern country. Its well known general agent, Dr. Sears, knows better than any one else what are the facts and meaning of southern affairs. Hence this movement by the Peabody trustees is entitled to the highest consideration.

And when, in addition to this, we remember the indorsement which this cause has received from the body of school superintendents, from the National Association of Teachers, from State legislatures, and from numerous other influential bodies, we may feel assured that the object will be atttained. But any object, however noble, having in it no war, politics, money, or magnetism, must be slowfooted in the press of congressional business and among the commonplaces occupying the popular mind. There are also oppositions.

When we ask for the proceeds of the public lands, although the kernel has largely been eaten out of the nut, we run against old party theories. Most men who have held these theories understand that theories are and ought to be modified in their action by circumstances, yet a full-blooded abstractionist knows nothing but to die by his theory. But a public man, whatever be his theory, will pay due respect to the public will.

Besides political and sectional jealousies, other interests antagonize this patriotic object. Private and corporate schemes are ever moving, or preparing to move, on the public domain. How little do the people of the United States generally know how largely their vast landed estate has thus been alienated. A well informed writer in the International Review gives us this statement of facts, which might well rouse the indignation of the public mind, if they are anywhere near the truth:

"Instead of laying the foundations of democratic equality in the soil itself, and thus taking 'a bond of fate' for the welfare of coming generations, the goading need of money and the very abundance of American lands paved the way for great monopolies, which have increased and multiplied ever since. The purchase of vast tracts by individuals and companies was not only allowed but encouraged by the Government. The policy of disposing of the public domain at low or nominal rates to actual settlers only, and in limited quantities, was not then dreamed of; and so potent was the influence of those feudal ideas which had been transplanted from the Old World that the enactment of the present homestead law did not become possible till seventy-five years after the establishment of the American land system. But this famous law did not emancipate the public domain. It was a sign of promise, but it did not fulfil the nation's desire. Non-resident speculators were still at liberty to purchase great tracts and hold them indefinitely for a rise in

price which was at war with the whole spirit and policy of the home stead law and as flagrantly unjust as it was financially stupid. The American system of land grants to railroad corporations, which originated in 1850, has already surrendered a territorial empire of over two hundred million acres! The Indian treaty system, fully inaugurated by Congress in 1861, has robbed poor settlers of great bodies of choice lands, and handed them over to monopolists and sharpers. The legislation on the subject of military land bounties, while nearly profitless to the soldier, has been a national disaster, beneficial only to speculators and monopolists. The acts of Congress on the subject of swamp lands and college and Indian scrip have been equally vicious and indefensible. The rights of settlers under the homestead and preëmption laws have been seriously threatened by Department rulings in the interest of railway companies, while the growing power of land monopoly has been formidably reënforced by the State and Federal courts. Under the vicious legislation to which we have referred, only one person in fifteen, outside of the towns and cities, is the owner of a home in the land States of the South. In the State of California quite a number of men own hundreds of thousands of acres each, and in crossing the lands of one of these you are obliged to travel seventy-five miles. These monopolists, in league with the navigation and railway companies and banking corporations of the State, naturally favor the cooly traffic, since it supplies a background of degraded and pauperized labor, on which a splendid aristocracy of wealth may fitly and securely flourish. The curse of monopoly in the States of the Northwest, caused by the cruel commerce in land which the Government has encouraged, has been an irreparable blight to their prosperity. Great estates are everywhere tending to swallow up the smaller ones and to produce a constantly multiplying and crouching tenantry."

When we read such statements, we understand at least in part why it is that when this matter is brought before Congress some mysterious agency clogs its movements.

Moreover, considering the tendency of all governments to ally themselves with property, rather than with the people, owing largely to a political economy which is as fallacious as it is inhuman, we ought perhaps not to be surprised at the shameful history of our squandered possessions. But it ought to be manifest that a radical change of management is demanded, and whenever these lands are set apart for the use and benefit of their owners, we may expect a wiser administration of this great subject.

An impediment of a different sort consists in the want of faith in popular education, which is not unknown even in the North and is common in the South, though much less common than it was twenty years ago. The unbelief in the South is readily accounted for by its adherence to old traditions, by the influence of English literature, by the institution of slavery, and above all by the controversy in respect to

slavery, which by the law of moral dynamics drove the defenders of slavery into a depreciation of the claims of laboring people and a denial of the power of common school education to improve this class. These views were applied a fortiori to the negro. The tremendous logic of events has made astonishing changes of sentiment, but the dregs of all these old ideas and feelings lie scattered about. And in addition to these the early post war history stirred up new difficulties, so that altogether we find that our cause has to wade through seas and sands, with now and then a battle.

And so we might speak of the opposition which comes from those who from theory or private interest or ecclesiastical influence oppose, or at least dislike, all governmental aid to education, although this form of opposition does not usually extend to the high grades of education. And to this wearisome list we might add the highstrung State rights men, who are very jealous of Federal gifts to the education of the people, but get very fearless of Federal money and Federal power when the river and harbor budget comes along.

But in dealing with public men we must bear in mind their representative character, and we must especially remember that our whole argument is based upon the fact that the people do rule. Representatives must therefore be persuaded that, even if the people have not already formally approved, they will approve of Federal contributions to education — Federal contribution, not Federal control, which latter all are opposed to.

It seems to me that any thoughtful man who understands this subject must be convinced that the people will not only approve this contribution, but will demand it, certainly to the extent of requiring the proceeds of the public lands to be set apart for this object. Put before the people for their votes a line of railroad through the Rocky Mountains on one side and a line of school-houses at home on the other, and can any one doubt which they would prefer? Ask the great West what it thinks of schools for the people as contrasted with thirty thousand acre wheat fields obtained at small cost out of the people's land. Ask the people of the Atlantic seaboard if it was with their consent that a semicontinental domain should be lavishly given to almost everybody and everything except to them, the original owners, buyers, or givers, who bought or gave for the common use and benefit; and, so far from getting anything back have seen their own property so used as to drain their States of population and increase their burdens.

You need not ask what the southern people think, or will think, when they come to understand that in one end of the scales is their salvation and the other a cage filled with corporation kings, land operators, and abstractionists of the old school! I shall only hint at the sentiment of Virginia when the story of the Northwest Territory is told once more.

The people all — West and East, South and North — will assuredly

understand this whole matter, and when they do understand it there will be no more need for argument.

Ideas, like seeds, cannot take root until the conditions are right. The moon must be in the right sign. Hitherto the conditions have not been right for this idea, but the conditions are now right, and we may confidently expect it to grow and spread, the only danger being that it will spread too wildly. The era of the oak is giving way to the era of the pine. God forbid that we should pass on to the era of broom sedge and prairie fires. By which I mean that the social and political era of the past is different from that of the present, and the present is possibly different from that of the future. The people are claiming more for themselves through the Government, and if this has to be accomplished by revolution it will run into a terrible socialism. My firm belief is that socialism cannot long prevail in a Government like ours. But we are on the line which points in that direction. The people, as distinguished from leaders, parties, and social belongings of all sorts, are coming to the front, and henceforth property, party, and government itself must become secondary and directly subservient to the interests of the people. The Massachusetts of to-day is not the Massachusetts of fifty years ago. The railroad riots of two or three years ago in Pennsylvania are something very different from the whisky insurrection. The sand-lot multitudes of California have a very different meaning from the nullifiers of the days of Andrew Jackson or the church burners of Philadelphia. The whole country wears a different aspect from what it wore forty years ago. The same may be said of Europe. And at the bottom of all is the same idea, and the impending dangers are the same in all. And out of all this may come something grandly good or horribly bad, according to the wisdom or folly of those who have the management of the crisis. This is no time for the reign of pessimism. True, we want eyes of honest discernment to see that there are real evils in social affairs, and to see just what they are, but we also want wise heads and brave hearts to devise and execute that which is best. This is not the occasion for discussing this subject fully, but the true line of action is indicated when I say that the safety of society lies not in T. R. Malthus, not in courts, policemen, or gunpowder, although temporarily all these might be needed. Where, then, must we look? To the people; to these threatening masses who, wrong, will rend society to pieces, but who, right, will be her grandest muniment.

In our southern country extreme conservatism has been the controlling spirit during most of our history, and it had much to recommend it. In its older aspects it was social feudalism, refined and knightly, and its typical representative was an honest gentleman. But no oligarchical form of society could be permanent in this country, and this had begun to relax before 1861. And the events of the war opened the eyes of the privileged class to the value of the common people. And after the war no man would have ventured to talk about the "mudsills" of society.

But in the post war period society was thrown into chaos by the sudden rise and speedy departure of an opposite condition of affairs. This was the carpet-bag period, whose lessons ought never to be forgotten, because it gave an ocular demonstration in most States of how suddenly and how surely death strikes to the heart of society when ignorance under the lead of rascality rules the land. And this period will go into history as the darkest of all. After it came a reaction in favor of conservatism. But the crystallizations of the past had been broken, and the scattered fragments could not be reunited. Society is still unsettled, and no man can forecast the future. Many good men are gloomy and despairing. Some would only croak and groan; others would curse and fight. But all this is foolish and unavailing. The panacea for the ills of society is not malevolence, but sympathy; and this sympathy must not be a sentimental vapor or a smiling hypocrisy, but be of that substantial sort which provokes an honest study of each other's wants. To put your arm around a shabby voter when leading him to the polls is one thing; to study how you may permanently better the man and improve his lot in life, is quite another thing.

Nearly thirty years ago Stephen Colwell brought a heavy indictment against the whole existing science of political economy, because it regarded the products of men as the chief concern of government, instead of the men themselves. And it has been pleasant to observe how students of social and governmental science are gradually reaching the conclusion that the main concern of governments ought to be, not railroads, tariffs, money, and such like, but the personal character and well being of the people. Property does not make men, but men make property. Shall we be forever worshipping the thing made and care not for the maker?

And when we are trying to move Congress in this matter of help to educate the people, we may claim that we are doing a great service in exalting the sphere of legislation. Could we only establish man as the central figure in this wearisome wilderness of legislation, we would perform a public service far beyond the value of the landed domain. We would put a splendid policy of insurance on all the great interests of society. If one-tenth part of the legislation and the money now spent on material interests were spent directly on the people, the material interests would largely take care of themselves.

The world has never yet fully tested the power of education in forming a free society, unless ancient Athens be an exception. Though education in the true sense is not compatible with arbitrary government, and must produce turbulence, education is life and health to a free government. We do not boast of our popular education; it might be, it ought to be a great deal better. Even in the States which have longest had school systems, children on an average do not get much over five months' schooling annually. And what are the school teachers of America compared with what they might be; and how many subjects ought to be

taught to the people, that are wholly omitted—moral, social, and governmental subjects of the greatest moment. Some people ridiculed General Burnside's bill to teach the virtues in the public schools, but this is not a suggestion to be whistled down the wind. What are all the things about which there is so much legislation, compared with a virtuous, enlightened, orderly, industrious people? And this sort of people are made, not born; and considered in mass they must be made by their governments, or they will not be made at all.

I know not what is true of Northern and Western States, but I can say for my State and for most of the Southern States, we are not able to educate our people in any tolerable sense; we are too poor to do it. A few years ago I showed this conclusively by statistics, and many of these statements you will find embodied in a printed document prepared by Hon. A. H. H. Stuart, of Virginia, and presented to the meeting of the Peabody trustees held on yesterday; and I still have a few copies of my original argument. There has not been much increase in financial ability in these States since that time—no increase on an average in my own State, so far as I can judge. And every well informed man knows that, whatever be the wants of a State, her power of taxation has a limit beyond which it must not go. By which is meant, not simply that there is a point beyond which the people will not go, but a point beyond which they ought not to go. It is, I think, a settled principle that taxation must keep within the average annual profits of the taxpayers; when it begins to eat into the capital of the country, it is like consumption of the lungs in the human constitution: decline sets in from that point. And there is no form of obligation which imposes upon a State the act of felo de se.

A State may press nearer to the extreme verge of ability in levying taxes for education than for almost any other object, because education is a reproductive force. But inasmuch as this force is gradual and somewhat slow in producing its effects, the cost of education might in some cases reduce the vitality of a State to so low a point that a fatal decline would set in before the point of reaction could be reached.

No doubt bold assertions have been made without much reference to the facts in regard to the ability or want of ability of some States to increase taxes, men being tempted to take one side or the other, according to their sentiments on other questions; but I fear that in a number of southern States the extreme limit of taxation has been reached. Although the ratio of taxes to the amount of property is less than in some prosperous States, the ratio of taxes to annual profits is exceedingly large. A low rate of taxation on a people not improving is more oppressive than a high rate on a prosperous people.

And in the South public education is a more costly affair than it is in the North, because of the necessity for having separate schools for white and colored children. If there are forty school children in a neighborhood, and one-half of them are white and the other half colored, there

must be two school-houses and two teachers, where otherwise one would be sufficient. It is idle for any one to suggest a mixture of the races. It can't be done. We must educate in separate schools, or not at all. When the ratio of the school tax is considered it will be seen that most of the Southern States are making liberal appropriations for education. But these appropriations must be greatly increased before the people can receive the training demanded by the public safety. And we must educate or surrender, and accept the destiny of Spain, and Turkey, and Mexico. We can become the Bœotia, the Ireland, the Poland of the American Government. We can die as to civilization, as many states have died before; we can hang as a body of death on the back of the Great Republic. But does the nation desire this? If not, why is it that a measure which has more medicine in it for the healing of the nation than all else put together has been so slow of recognition in quarters where prompt sympathy might justly have been anticipated?

On what principle of humanity or self-interest could the nation justify indifference to a group of States which have in them even now so much that is admirable, so many men and women of the highest type, so many young men in whose blood courses the culture of centuries, so many warm hearts that could be made enthusiastic for their country? These are the elements which give dignity and moral power to a nation; and that government is blind or jaundiced which will allow such glories to perish.

And to these add the material outcome of these southern States in their mineral wealth, in their tobacco, cotton, rice, sugar, tropical fruits; and, in the future, tea certainly, and perhaps coffee, cinchona, and many other valuable productions not yet introduced. By the fiat of God the nation must look south for these things or do without them.

Now ought a proposition to give a very little help to a very great cause like this—ought such a proposition to be compelled to watch and scheme and fight for even a half hour's consideration on the floor of Congress? And may not Congress with all propriety do what we ask? One of the chief functions of every government is to avert dangers and cure evils which are beyond the ability of the members affected. Indeed there is no definition of the object of government which will bear examination except this, that its object is the good of the people. I do not forget the complex nature of our American Government. I was brought up on the controversy as to State rights and Federal rights; but, without rearguing dead issues, it might be enough for us to say that this is not like ordinary petitions for aid; it is simply asking for a return, to the owners, of property which Congress is holding as fiduciary, and which the suffering owners need for necessary current expenses. There need not be any constitutional qualms on the subject. And, even if anybody would wish to honor the ashes of a defunct controversy, he would get his fingers dreadfully burned if he were to act upon it. For

here is Congress now actively engaged in the work of improving harbors, deepening rivers, establishing light-houses, granting subsidies to railroads, geologizing the Rocky Mountains, surveying the country in order to have accurate maps and charts, maintaining life saving stations along the coast, and engaging in other wise and beneficent enterprises. If Congress may do these things, there can be no question as to its power to make appropriations in aid of the most important of all causes, the formation of national character and the rescue of the people from degradation and misery.

THE NEGRO.

Coming as I do from a southern State, Mr. President and brother superintendents, you will expect me to say something specially about the negro, whose fate is to be determined largely by what the Federal Government does for him or leaves undone.

It is just ten years since I entered upon my present work; and I have studied nothing so much as the negro, because he is an enigma, and yet a part of my work. I have seen him in all sections of my own State. I have read everything I could find in regard to him everywhere. I have listened to everything pro and con that anybody had to say about him. And my impression in regard to his spirit and capacity is just this:

(1) He wants to do right, and he is the most amiable of the races. He is also the most religious of human beings, and the character of his religion is improving. It controls his daily life more than formerly. Among these people there are many centres of great moral power.

(2) The negro craves education, and I believe that this desire has increased. It certainly has not diminished. He makes fully as great sacrifices to send his children to school as the laboring classes of whites.

(3) The civilization of the race is progressing, and even faster than his thoughtful friends anticipated.

(4) The negro is fond of politics, and he has just one principle of political action, and that is to go with those who will do most, or lead him to think they will do most, to advance his interest. He has an eye to the past, but a much sharper eye to the future. He has no strong faith in men or parties, and he will go hither and thither according as his confidence is gained at the moment. He is most suspicious of those who have heretofore formed the controlling element in southern society and politics. There are occasional divisions of political sentiment among the negroes, but the great body of them move in mass, thus giving an illustration of "the unanimity of ignorance."

(5) But finally, as a class, they are in character weak and ignorant, and hence to that extent a dangerous element in society. We cannot expect that the mass of them, any more than the mass of ignorant white people, will be controlled by high and broad views while in their present condition; and there is no way of making them safe members of society but by educating them. The negroes are a highly improvable

race. A surprising proportion of enlightened, right thinking men have already risen from their ranks, men who have taken a respectable position: some in the learned professions, some in editing and printing newspapers, and some in the management of business; and, what is not less commendable, great numbers are living worthy lives in the humble occupations. The colored children learn well at school and show good effects promptly. But the kind and amount of education they are receiving or can receive with our present means is wholly inadequate to the great work of fitting them as a race for duties laid upon them by the Federal Government. And the race generally is far below the demands made upon it. No stronger claim to education ever existed than the claim of the negro race in these Southern States upon the Government which set them free and made them citizens; and this claim will be rung in the ear of Congress until itis responded to. It is a great plea of so much force in itself and supported by collateral reasons of such tremendous weight that it must prevail.

SUMMARY.

In conclusion, the points made or assumed in the remarks now made are: (1) That there is an enormous and most dangerous mass of ignorance existing in the whole United States, and that this is particularly true of the southern States, where the poor circumstances of the people forbid an effective system of common school education; (2) that these ignorant classes, white and colored, improve readily under right influences; (3) that we have entered upon a peculiarly critical period, in which there is an ominous disposition on the part of the masses of the people to discard old leadership and to lay hold of the controlling forces of society; (4) that safety and justice alike demand that the people shall be educated in right views and habits, and thus be made the unconquerable defenders of order and property; (5) that the subject demands the immediate attention of the Congress of the United States.

THE BILLS BEFORE CONGRESS.

There are now two bills before Congress—one before the Senate and one before the House—each of which provides that the proceeds of the public lands shall be set apart for education. But there are important differences between these bills. The one before the Senate (No. 133) adds to the income from lands the income also from patents. Both bills contain the excellent feature that for the first ten years the apportionment among the States shall be made on the basis of the illiterate population over ten years of age; but the Senate bill requires that one-third of the money shall be given to the agricultural colleges established under the congressional act of 1862. This I regard as a very objectionable feature. It is well known that as a rule these colleges have been failures; but even if they were less open to criticism their claims for subsidy are insignificant compared with the claim of the great body of

the people for a decent common school education. The House bill (No. 334) provides that one-fourth of this money shall be given to those colleges unless "the State legislature shall otherwise direct." This is better, but it would have been still better to say that one-fourth *may* be so given.

The Senate bill provides also that after the first year the income from lands and patents shall be invested and only the interest apportioned. This would be affording a very slight relief to States which are now in great need and whose circumstances may be expected to improve. The House bill for the first five years distributes the whole income, and after five years distributes half and invests half. This is far better. The pinch with the Southern States is now.

The terms on which this money is to be distributed are wholly unobjectionable, and include no kind or degree of control by the Federal Government over education in the States. Nothing is required but a report showing that the money has been applied to the free education of the children. I think it would be well to require that this report should contain a summary of the educational statistics of the State for the benefit of the Bureau of Education.

Mr. ORR, of Georgia, followed, indorsing very fully the points made by Mr. Ruffner, but excused himself from making any extended remarks, saying he had already discussed the subject before the association, and his speech had been printed and extensively circulated.

Messrs. PHILBRICK, WICKERSHAM, and ARMSTRONG each spoke briefly, but very cordially indorsed Mr. Ruffner's resolution, which was adopted unanimously.

The department then adjourned sine die.

APPENDIX A.

LAWS RELATING TO THE ESTABLISHMENT AND GOVERNMENT OF THE STATE PUBLIC SCHOOL FOR DEPENDENT CHILDREN, LOCATED AT COLDWATER, MICH.

The first eight sections are omitted, as they relate only to the location of the school and the construction of the buildings.

SEC. 9. The general supervision and government of said State public school shall be vested in a board of control, to consist of three members, who shall be appointed by the governor, by and with the advice and consent of the senate; the members of which board shall hold their offices for the respective terms of two, four, and six years from the last day of the session of the legislature next after the completion of said State public school building and until their successors shall be appointed and qualified, said respective terms of office to be designated in their several appointments; and thereafter there shall be one of said board appointed every two years, whose term of office shall continue for six years, or until his successor is appointed and qualified. The members of said board shall constitute a body corporate, under the name and style of the "Board of Control of the State Public School," with the right of suing and being sued, of making and using a common seal, and altering it at pleasure. That said board of control shall have the power of taking and holding, by purchase, gift, donation, device, or bequest, real or personal estate to be applied to the use of the institution.

SEC. 10. It shall be the duty of said board of control to meet once in three months on its own adjournments, and oftener if necessary; that the said board shall elect from its own number a president, secretary, and treasurer, each of whom shall hold his office during the pleasure of said board; that the said treasurer shall give his bond to the people of this State, with two or more sufficient sureties to be approved by said board and the governor, in the penal sum of at least ten thousand dollars, or in such additional penal sum as said board may require, conditioned for the faithful performance of the duties required of him by law, and to account for and pay over as required by law all moneys received by him as such treasurer. The said board of control shall establish a system of government for the institution, and shall make all necessary rules and regulations for enforcing discipline, imparting instruction, preserving health, and for the [proper] physical, intellectual, and moral training of the children. The said board shall appoint a superintendent, a matron, and such other officers, teachers, and employés as shall be necessary, who shall severally hold their offices or places during the pleasure of said board; and that said board shall prescribe their duties and fix their salaries, subject to the approval of the governor.

SEC. 11. There shall be received as pupils in said school those children who are declared dependent on the public for support, as provided in this act, who are over three and under fourteen years of age, and who are in suitable condition of body and mind to receive instruction. That said board is authorized, in admitting children, to give preference to those under twelve years of age. That those admitted, unless sent from the institution as provided by this act, shall be retained until they are sixteen years of age, and may be retained after that age, in the option of said board, until a home is procured for them. That said board is authorized to return to the county sending

it any child when it shall become sixteen years of age and no home has been procured, or whenever after its admission it shall be ascertained to the satisfaction of said board that the child was of unsound mind or unsound body at the time of its admission, or if for any other reason said board shall consider said child an improper inmate of said school; that, in the case of the return of any child as herein provided to the county sending it, the guardianship of this board shall cease, and the child shall again become a charge on the county sending it. The said board of control shall report in writing to the superintendents of the county poor of the proper county the reason for returning the child.

SEC. 12. The children in such school shall be maintained and educated in the branches usually taught in common schools, and shall have proper physical and moral training.

SEC. 13. It is declared to be the object of this act to provide for such children only temporary homes until homes can be procured for them in families. It shall be the duty of such board of control to use all diligence to provide suitable places in good families for all such pupils as have received an elementary education; and any other pupils may be placed in good families on condition that their education shall be provided for in the public schools of the town or city where they may reside. That said board of control are hereby made the legal guardians of all the children who may become inmates of said school, with authority to bind out any child to a pursuit or trade during minority, under a contract insuring the child kind and proper treatment and a fair elementary education.

SEC. 14. That whenever there shall be sufficient room for the reception of the class of children described in this act in such State public school, no such children shall hereafter be maintained in county poorhouses. That in receiving such children into such school preference shall be given first to dependent and indigent orphans or half orphans of deceased soldiers and sailors of this State.

SEC. 15. As soon as the State public school buildings are ready for the admission of inmates, and thereafter semiannually, and whenever inquired of by the superintendents of the poor, it shall be the duty of the secretary of the board of control to notify the superintendents of the poor of each county how many children of the county notified can be received in said school. That the admission for dependent children in said school shall be, as near as practical, divided among the several counties in proportion to the number of dependent children in each. That it shall be the duty of the superintendents of the poor of each county to forward to said school any dependent and neglected children that are entitled by this act to admission thereto in the manner herein provided. All expenses attending the forwarding of such children, and of the examination herein provided for, and of returning to the counties where they belong children not entitled to admission, shall be defrayed by the county to which they belong, by the county treasurer, out of the funds appropriated to the support of the poor belonging to such county, after being allowed and certified by the county superintendents.

Section 15 was amended April 5, 1875, by the following section: "The expense of transportation of children who may be sent to said school pursuant to law shall be audited by the board of State auditors and paid out of the general fund."

SEC. 16. Before the superintendents of the poor shall send any child to said school, they shall cause him to be brought before the judge of probate in the county where the child belongs, for examination by the judge of probate as to his alleged dependence; and it shall be the duty of the superintendents of the poor of each county, in the case of children in the poorhouses or other children which shall be found in a state of want or suffering or being abandoned or improperly exposed, or children in any orphan asylum where the officers thereof desire to surrender them to the care of the State, whenever there shall be a vacancy for their county in said school, to bring such children before the said judge of probate for said examination; and it shall thereupon be the duty of the said judge of probate to investigate the facts in each

case and ascertain whether such children are dependent; their ages, names, and residence of parents, and in what county, poorhouse, or orphan asylum they have been kept, if any, and for how long a time; and said judge of probate shall have power to compel the attendance of witnesses, and may, in his discretion, request the attendance of the prosecuting attorney for such examinations; and, if so requested, it shall be the duty of such prosecuting attorney to attend in behalf of the county. The parents or any friend may appear in behalf of any child, and, in his discretion, the said judge of probate may request any supervisor of any town or ward to appear in behalf of any child; and if, on such examination, the said judge of probate shall find that any child is dependent and neglected, he shall enter such finding by a proper order in the journal of the probate court in his office, and shall deliver to the superintendent of the poor procuring such examination a certified copy of such order, which shall contain, besides said findings, a statement of the facts, so far as ascertained, as to the age of the child, names and residence of parents, and name of the county poorhouse or orphan asylum where the child has been maintained, and the length of time of such maintenance; and in the case of the examination of two or more children at the same time, only one order need be made; and said certified copy of said order shall be delivered with the child at said school to the superintendent thereof.

SEC. 17. It shall be the duty of said board of control to provide and always keep open for inspection of all persons desiring to examine it a book in which shall be registered the names and ages of the children received in said school, and the residence of parents as near as can be ascertained, in which book shall also be recorded the date when the child is received and when the child left the school, and whether the child was apprenticed, placed in a family, or otherwise, and, if placed in a family, the name, residence, and occupation of the head of such family, and, if apprenticed, to whom.

SEC. 19. The said board of control is authorized to designate some officer, teacher, or other employé connected with said school to act as the agent thereof, and who shall act in that capacity during the pleasure of said board of control, and shall be known as the agent of the State public school; and his duties as such agent shall be prescribed by said board, and shall include the visiting, as often and at such times as said board of control shall determine, any and all children placed in charge of any person by said board of control; to inquire into the condition of such children, and make such investigation as may be necessary in relation thereto, and report the same to said board of control; to investigate all applications to take such children, by adoption or otherwise, to such suitable persons who are willing to adopt, take charge of, or otherwise take and keep any children sent to said school, and to enter into a contract in writing, in behalf and under the instructions of said board of control, with the persons taking such child; and all such contracts shall contain a clause reserving to said board of control the right to withdraw the child from any person having him when, in the opinion of the board, the welfare of the child requires it. The said agent, while acting as such, shall be paid his necessary travelling expenses by the treasurer of said board of control, after being allowed and certified by said board of control.

SEC. 20. The said board of control shall make out biennially and report to the legislature at its regular session a detailed statement of the operations of said institution for the two years closing with the fiscal year preceding said session, which shall include a report of the treasurer of the board of all receipts and disbursements for the same period. It shall also be the duty of said board to cause to be made out by the superintendent or other proper officer and forwarded to the office of the superintendent of public instruction, on or before the first day of November in each year, a report for the fiscal year, setting forth the condition of the institution, the amount of receipts and expenditures, the number of teachers and other officers and compensation of each, the number of inmates that have received instruction, the studies pursued and the books used; also, the mode of instruction and discipline prescribed, and such

other information and suggestions as may be deemed important or the superintendent of public instruction may require to embody in the report of his department. The members of said board shall be allowed the expenses necessarily incurred by them in the discharge of their official duties and three dollars per day for their official services actually and necessarily performed, which shall be audited by the board of State auditors.

SEC. 21. That whenever the superintendents of the poor of any county shall bring any child before the judge of probate for examination as to his alleged dependence, as provided in section sixteen of this act, they shall present to said judge an application in writing, which shall be filed in his office for such examination, which shall be signed by at least two of said superintendents, in which they shall certify that in their opinion the child named is dependent on the public for support, and that he has no parents against whom his support can be enforced, as provided in chapter forty-nine of the compiled laws of eighteen hundred and seventy-one.

SEC. 22. That the superintendent or agent or board of control of the State public school is hereby authorized to consent to the adoption of any child who has or shall become an inmate of said institution by any person or persons pursuant to the provisions of an act entitled an act to provide for changing the names of minor adopted children and of other persons, approved February second, eighteen hundred and sixty-one, and that on such adoption the said board of control shall cease to be the guardian of the child so adopted.

SEC. 23. That whenever on [the] examination provided for in this act the judge of probate shall determine that the child is dependent on the public for support, he shall cause it to be examined by the county physician, if there be one, and, if not, then by a respectable practising physician, and shall in no case enter the order in his journal showing the child is admissible to this school unless the physician making such examination shall certify in writing, under oath, filed in said court, that the child examined by him is, in his opinion, of sound mind and has no chronic or contagious disease, and in his opinion has not been exposed to any contagious disease within fifteen days previous to such examination before the judge of probate; that a copy of such certificate shall be attached to the other papers provided by this act, to accompany each child to this school.

DUTIES OF COUNTY AGENT REPRESENTING STATE BOARD OF CORRECTIONS AND CHARITIES.

SECTION 1. *The people of the State of Michigan enact*, That the governor may appoint in each county of this State an agent of the board of State commissioners for the general supervision of charitable, penal, pauper, and reformatory institutions, who shall hold his office at the pleasure of the governor. * * * Said agent shall receive as compensation for his time and services his actual expenses necessarily incurred while engaged in the performance of his duties under this act, on being fully stated in account and verified by the affidavit of the agent, together with the sum of three dollars in full for his services in each case investigated and reported upon, as hereinafter prescribed; [which] when approved by the governor, shall be paid by the State treasurer, on the warrant of the auditor general, out of any money in the treasury not otherwise appropriated: *Provided*, That the sum so allowed for the services of such agent in any county, except the county of Wayne, shall not in any one year exceed the sum of one hundred dollars, and that in the county of Wayne the sum so allowed for such services shall not in any one year exceed the sum of two hundred dollars.

SEC. 3. Said agent shall as often as once in each year visit all children resident in the county for which he is appointed who shall have been indentured or placed in charge of any person therein by any State board or officer of the State, and shall inquire into the management, condition, and treatment of such children, and for that purpose may have private interviews with such children at any time; and if it shall come to the knowledge of such agent that any child thus placed in charge of any per-

son as aforesaid is neglected, abused, or improperly treated by the person having such child in charge, or that the person holding the child is unfit to have the care thereof, he shall report the fact to the board or officers of the institution by which such child was indentured, and such board or officers shall cancel the contract and cause the child to be returned to the institution from whence he or she was taken, or indentured to some other person, or to be discharged, in the discretion of the board of officers. In all contracts or indentures for binding out children from any State institution the officers making the same shall expressly reserve the right to cancel the contract whenever in their judgment the interests of the child are not properly cared for.

SEC. 4. No child shall be indentured, adopted, or taken during minority by any person not of kin thereto from a State institution until notice of an application therefor has been given to the agent aforesaid residing in the county from which such application is made, and until his report in writing, made after an investigation into the propriety thereof, has been made and filed with the officers of such institution. And all applications for the release or discharge of any children so indentured or placed in charge of persons in such county shall be given to said agent for his report in like manner.

SEC. 5. It shall be the duty of said agents in their respective counties to seek out suitable persons who are willing to adopt, take charge of, educate, and maintain children arrested for offenses, committed to any State institution, or abandoned and neglected children in charge of any State institution or officers, and to give notice thereof to the boards or officers having authority to dispose of such children. And said agents shall from time to time make report of their doings under this section to the board of which they are agents.

SEC. 6. * * * Said agent shall also keep a brief history of each child within his county discharged as aforesaid, in a manner and form to be prescribed by the board of which he is agent, and report the same from time to time to said board as it may require, to the end that the effect of the treatment and discipline of the several institutions of the State for the care and reformation of juvenile delinquents upon their discharge therefrom may be better known and understood.

SEC. 7. This act shall not apply to any county of the State in which no agent shall be appointed by the governor under and by virtue of the provisions hereof.

REGULATIONS OF THE BOARD OF CONTROL CONCERNING RECEIVING AND INDENTURING CHILDREN.

(1) The superintendent is authorized and instructed to be and act as the agent of the State Public School. All correspondence between the institution and county officials agents of the board of corrections and charities, and those to whom children are indent ured, shall be conducted by him. He shall divide the admissions pro rata amongthe counties, as provided by law, and shall notify county officials when children can be admitted. When practicable, on receiving new children, they shall be detained ten days in the hospital for quarantine.

(2) It is also the special duty of the agent to procure good homes for the children and supervise them after indenture. He shall cause each child indentured to be visited at least once each year by the agent of the State board of charities and corrections of the proper county where there is one, and where there is none by some county officer. He shall also require the person with whom the child lives to report concerning the child at least once in each year. It shall be the duty of the agent to see that all contracts of indenture are faithfully executed and that all violations of such contracts are promptly reported to the board. Whenever he shall ascertain that the interest of the child requires the can cellation of any such contract, he is authorized, with the approval of the agent of the State board of charities and corrections, to return such child to the school, subject to the action of the board.

(3) No child shall be indentured for a less term than provided by law. In all in-

denture contracts the time fixed for the child to attend school will be determined by the age and education of the child when it leaves the school. It will be the object of the agent to secure a good education for the child rather than the payment of money. The agent will make special effort to place the children by indenture in the country, and to avoid as far as possible placing the older children in large villages or cities.

(4) No child is to be retained in the institution when it can be placed in a suitable home, but the object of the institution is not to hurry children into poor homes. The welfare of the child is the first and last object to be attained. In indenturing and supervising children, especial attention is requested to the law controlling this institution.

(5) The following are suggested as suitable forms for applying for and indenturing children. In addition to these, the superintendent shall prepare and use suitable blanks for ascertaining the condition of indentured children and securing the faithful execution of the indenture contracts:

STATE OF MICHIGAN.

To the board of control of the State public school:

I hereby make application to have ——— ———, one of your wards, indentured to me during minority, pursuant to an act entitled "An act to establish a State public school for dependent and neglected children," approved April 17, 1871, and the acts amendatory thereof. I am a resident of ———, in the county of ———, and my post-office address is ———. My occupation is that of ———, and my home consists of the following real estate owned by me: ——— ———. My family consists of the following members: ——— ———. The district school, which is maintained at least three months ,each year, is — mile- from my residence.

Dated ——— ———, 188-.

To the board of control:

After a careful investigation, I hereby certify that the above-named applicant is a resident of the place named by him, where he has a good home. That he is a person of good moral character, is temperate, does not sell intoxicating liquor as a beverage, and that I believe he will properly provide for, educate, and otherwise faithfully execut the contract indenturing the child to him.[1]

Dated, ———, 188-.

STATE OF MICHIGAN.—BOARD OF CONTROL OF THE STATE PUBLIC SCHOOL.

This agreement between the board of control of the State public school, by authority of an act entitled "An act to establish a State public school for dependent and neglected children," approved April 17, 1871, and the other acts amendatory thereto, of the first part, and ——— ———, of the town of ———, witnesseth that it is mutually agreed between said parties by these presents, as follows:

That said board hereby places ——— ———, an inmate of said institution, in the family of said ——— ——— until the ——— day of ———, 18—, when the child will be 21 years of age, reserving the right to cancel this agreement and return said child to this institution whenever, in the opinion of this board, the conditions of this contract are not faithfully executed, or when otherwise the interest of the child requires it.

The said ——— ——— takes the child and agrees to keep it until said ——— day of ———, 18—, treating it kindly and parentally as his own child (except as to in-

[1] The recommendation must be signed by the agent of the State board of corrections and charities, if there is one in the county where the applicant resides, and, if not, then by any county officer or two respectable citizens of that county. Before placing a child on trial or indenturing the same it must be made to appear satisfactorily to the superintendent that the applicant is temperate, does not sell intoxicating liquors as a beverage, that he has a good home, and is a person of good moral character, and will faithfully execute the contract indenturing the child to him.

heritance of property). That he will provide it with suitable apparel, both for working days and for attending public religious worship, and with suitable food, and all other necessaries in health and in sickness. That he will teach it the business of ——, and the branches usually taught in the common schools, and will have it attend the district school where he resides at least three months in each year. That if the child remains with him until the expiration of said time he will then pay it the sum of —— dollars and two good suits of clothes. That whenever requested by the superintendent of this institution, he will report in writing to him such facts in regard to the child as he shall request, and that he will furnish the child with materials and opportunity to correspond with said superintendent.[1]

In witness whereof the said board of control, by the agent of this institution, hereby sets its hand and seal this —— day of ——, 18—.

(Signed) —— ——, [L. S.]
Agent of the State Public School.

(Signed) —— ——. [L. S.]

[1] In case the person taking the child hereafter desires to adopt it, blanks and instructions will be furnished by addressing the superintendent at Coldwater. In case of adoption, the child becomes the heir at law of the person adopting it.

APPENDIX B.

AN OUTLINE OF THE SCHOOL SYSTEMS OF THE VARIOUS STATES.

I.—CHIEF EDUCATIONAL OFFICER.

His appointment, duties, &c.

INDEX.

a. Title, mode of appointment, and term.
b. Visitation and addresses.
c. Relation to school moneys.
d. Judicial functions.
e. Prepares blank forms.
f. Receives reports or collects statistics.
g. Makes reports.
h. Ex officio relations.
i. Power in regard to State licenses.
j. Power to bring actions.
k. Power as to text books.
l. Power to make appointments.
m. Miscellaneous.

ALABAMA: (*a*) State superintendent of education, elected by the people for two years; (*b*) visits each county yearly; (*f*) receives statistical and financial reports from county superintendents; (*g*) makes annual reports to the governor; (*l*) appoints county superintendents.

ARKANSAS: (*a*) State superintendent of public instruction, elected by the people for two years; (*b*) holds normal institutes annually in each judicial district; (*c*) apportions school revenues semiannually; (*d*) construes the school law; (*e*) prepares and distributes blank forms; (*f*) receives reports from county examiners; (*g*) makes annual reports to the governor; (*h*) is secretary of the board of commissioners of the common school fund; (*i*) issues State certificates; (*j*) brings suits to recover misapplied school money; (*k*) recommends text books.

CALIFORNIA: (*a*) Superintendent of public instruction, elected by the people for four years; (*b*) visits the different counties; (*c*) apportions State school funds, and draws warrants for the proper disbursements; (*e*) prepares blank forms; (*f*) receives reports; (*g*) makes reports to the governor; (*h*) is secretary of State board of education and chairman of State board of examination.

COLORADO: (*a*) Superintendent of public instruction, elected by the people every two years; (*b*) visits counties and delivers addresses; (*c*) apportions school revenues semiannually; (*e*) prepares and distributes blank forms; (*f*) receives reports from county superintendents; (*g*) makes biennial reports to the governor; (*h*) is president of the State board of education; (*l*) may appoint an assistant librarian.

CONNECTICUT: (*a*) Secretary of State board of education, appointed by the board for an indefinite term; (*b*) visits different parts of the State; (*e*) causes blank forms to be printed and distributed; (*g*) makes annual reports to State board; (*m*) receives and distributes educational State documents.

DELAWARE: (*a*) Superintendent of public instruction, appointed by the governor annually; (*b*) visits every school once each year; (*g*) makes annual report to the governor; (*i*) examines and licenses teachers.

FLORIDA: (*a*) State superintendent of public instruction, appointed by the governor for four years; (*d*) hears appeals; (*e*) prepares blank forms; (*f*) receives statistical reports from county superintendents; (*g*) makes reports to the governor; (*h*) is

president of the State board of education; (*i*) examines candidates for State license, and issues the same.

GEORGIA: (*a*) State school commissioner, appointed by the governor for four years; (*b*) visits different parts of the State and delivers addresses; (*c*) apportions school revenues; (*d*) construes school law and hears appeals; (*e*) prepares blank forms; (*g*) makes reports to general assembly; (*j*) causes actions to be brought for misapplication of school moneys.

ILLINOIS: (*a*) State superintendent of public instruction, elected by the people for four years; (*b*) visits State educational institutions; (*d*) construes school law; (*e*) prepares blank forms; (*f*) receives reports from county superintendents; (*g*) makes reports to the governor; (*h*) is secretary of State board of education; (*i*) examines candidates for State license, and issues the same.

INDIANA: (*a*) State superintendent of public instruction, elected by the people for two years; (*b*) visits counties and delivers addresses; (*c*) apportions school revenues; (*d*) construes school law and hears appeals; (*e*) prepares blank forms; (*f*) receives reports from county superintendents and from county auditors; (*g*) makes reports to the governor and the general assembly; (*h*) is president of State board of education and trustee of State normal school; (*j*) causes actions to be brought for misapplication of school moneys.

IOWA: (*a*) State superintendent of public instruction, elected by the people for two years; (*b*) visits teachers' institutes; (*d*) construes school law and hears appeals; (*f*) collects statistics; (*g*) makes reports to the general assembly; (*h*) is regent of the State university.

KANSAS: (*a*) State superintendent of public instruction, elected by the people for two years; (*b*) visits each county at least once in his term; (*c*) apportions school revenues; (*d*) construes school law, and hears appeals from joint school districts; (*e*) prepares and distributes blank forms; (*f*) receives reports from county superintendents; (*g*) makes biennial reports to the governor; (*h*) is member of State board of education and secretary of State board of school-fund commissioners; (*k*) recommends text books; (*l*) may appoint an assistant superintendent of public instruction.

KENTUCKY: (*a*) Superintendent of public instruction, elected by the people for four years; (*c*) has general supervision of public schools; (*d*) construes school law and hears appeals; (*e*) prepares and distributes blank forms; (*f*) receives reports from county superintendents and certain State institutions; (*g*) makes annual reports to the legislature; (*h*) is member of State board of education.

LOUISIANA: (*a*) State superintendent of education, elected by the people for four years; (*b*) visits each parish at least once a year; (*c*) makes quarterly apportionment of school money; (*f*) receives reports from parish trustees; (*g*) makes annual reports to auditor of State, State board of education, and general assembly; (*h*) is secretary of State board of education.

MAINE: (*a*) State superintendent of common schools, appointed by the governor for three years; (*g*) makes annual reports to the governor and council; (*h*) is superintendent of State normal school; (*m*) prescribes the studies for the common schools.

MARYLAND: (*a*) State superintendent of public instruction ex officio; (*h*) is secretary of the State board of education and president of the State Normal School. By virtue of the latter office he is State superintendent.

MASSACHUSETTS: (*a*) Secretary of State board of education, appointed by the board; (*b*) visits schools and delivers addresses; (*g*) makes annual reports. The State board appoints three *general agents*, who, acting under the secretary of the board, visit the schools and supervise school work.

MICHIGAN: (*a*) State superintendent of public instruction, elected by the people for two years; (*b*) visits institutes and delivers addresses; (*c*) apportions school revenues; (*d*) construes the school law; (*e*) prepares blank forms; (*f*) receives reports from superintendents of schools and all State institutions; (*g*) makes reports to the governor.

MINNESOTA: (*a*) Superintendent of public instruction, appointed by the governor,

with consent of the senate, for two years; (*b*) meets county superintendents by judicial districts; (*e*) prepares and distributes blank forms; (*g*) makes annual report to the legislature; (*m*) holds teachers' institutes as may be practicable.

MISSISSIPPI: (*a*) State superintendent of public instruction, elected by the people for four years; (*b*) visits different parts of the State; (*d*) construes school law; (*e*) prepares blank forms; (*f*) may require reports from county superintendents; (*g*) makes reports to the legislature; (*h*) is president of State board of education.

MISSOURI: (*a*) State superintendent of public instruction, elected by the people for four years; (*b*) visits congressional districts, spending five days in each yearly; delivers lectures; (*c*) apportions school revenues; (*d*) construes school law; (*f*) receives reports from county school commissioner (superintendent); (*g*) makes annual reports to the governor or legislature; (*h*) is president of State board of education and regent of State normal school.

NEBRASKA: (*a*) State superintendent of public instruction, elected by the people for two years; (*b*) visits institutes and delivers lectures; (*c*) apportions school revenues; (*d*) construes school law; (*e*) prepares blank forms; (*f*) receives reports from county superintendents and State institutions; (*g*) makes reports to the governor; (*h*) is member of normal school board; (*i*) issues State certificates; (*k*) prescribes text books to be used in all schools.

NEVADA: (*a*) State superintendent of public instruction, elected by the people for four years; (*b*) visits every county at least once each year; (*c*) makes semiannual apportionment of school revenues; (*e*) prepares and distributes blank forms; (*f*) receives reports from county superintendents; (*g*) makes biennial reports to the governor; (*m*) holds annual State teachers' institute.

NEW HAMPSHIRE: (*a*) Superintendent of public instruction, appointed by the governor and council for two years; (*e*) prepares and distributes blank forms; (*f*) receives reports from cities and towns; (*g*) makes reports to the legislature; (*m*) is expected to "guide and direct the interests of popular education."

NEW JERSEY: (*a*) State superintendent of public instruction, elected by the State board of education for three years; (*b*) addresses all the teachers annually at county institutes; (*c*) apportions school revenues; (*d*) decides disputes under the school law and hears appeals; (*e*) prepares and distributes blank forms; (*f*) receives reports and collects statistics; (*g*) makes reports to State board of education; (*h*) is secretary of State board of education; (*i*) the State superintendent, together with the principal of the State Normal School, issues State certificates of three grades, the first being for life: (*m*) furnishes questions used by the county boards of examiners.

NEW YORK: (*a*) Superintendent of public instruction, elected by the legislature for three years; (*b*) has power to visit all public schools and to appoint boards of examination; has general supervision of teachers' institutes; (*c*) apportions school moneys; (*d*) decides appeals in school affairs; (*e*) prepares blank forms; (*f*) receives statistical and financial reports from school commissioners and from various State institutions; (*g*) makes annual reports to the legislature; (*h*) is a regent of the State university and superintendent of the State normal schools; (*i*) issues temporary licenses to teachers, grants State licenses upon examination, and can revoke the same; (*l*) appoints local boards for the normal schools and conductors of institutes; (*m*) can veto the appointment of teachers for the normal schools; can annul teachers' licenses; can remove school commissioners.

NORTH CAROLINA: (*a*) Superintendent of public instruction, elected by the people for four years; (*c*) signs all requisitions on the State auditor for the payment of money out of the State treasury for school purposes, and apportions State school revenues by order of the State board of education; (*e*) prepares and distributes blank forms; (*f*) receives reports from county school officers; (*g*) makes annual reports to the governor; (*h*) is secretary of State board of education, member of council of State, and member of board of trustees of public libraries; (*m*) causes the school laws of the

State to be published and distributed, looks after the school interests of the State at large, and recommends such improvements in the school law as may occur to him.

Ohio: (*a*) State commissioner of common schools, elected by the people for three years; (*b*) visits institutes and delivers addresses; (*c*) supervises school funds; (*d*) construes school law; (*e*) prepares blank forms; (*f*) collects school statistics; (*g*) makes annual reports to the governor; (*i*) signs certificates issued by State board of examiners; (*l*) appoints State board of examiners.

Oregon: (*a*) State superintendent of public instruction, elected by the people for four years; (*b*) has general supervision of schools and school officers; (*f*) receives reports from county superintendents; (*g*) makes biennial report to the legislature; (*h*) is secretary of State board of education; (*m*) holds annual State teachers' institute at the capital and local institutes in the judicial districts.

Pennsylvania: (*a*) State superintendent of public instruction, appointed by the governor for four years; (*c*) signs warrants on the State treasurer for payment of appropriation to the several districts; (*d*) construes the school law; (*e*) prepares blank forms; (*g*) makes reports to the governor and legislature; (*l*) commissions county, city, and borough superintendents, and fills vacancies in office of county superintendent; appoints trustees for normal schools and examining committees to same.

Rhode Island: (*a*) Commissioner of public schools, appointed annually by the State board of education; (*b*) visits each school district as often as possible, and delivers addresses; (*c*) apportions the annual State appropriation; (*d*) hears appeals from decisions of school officers; (*e*) prepares blank forms; (*f*) receives reports from the towns; (*g*) makes annual report to State board of education; (*h*) is secretary of State board of education, and member of board of trustees of State normal school; (*k*) secures uniformity of text books as far as he can by recommendation.

South Carolina: (*a*) State superintendent of public instruction, elected by the people for two years; (*b*) visits counties and delivers addresses; (*c*) manages school funds and revenues; (*d*) construes school law; (*f*) receives reports from county school commissioners; (*h*) is chairman of State board of examiners, trustee of State university, and member of board of commissioners of institute for deaf and dumb; (*k*) secures uniformity in text books.

Tennessee: (*a*) State superintendent of public instruction, appointed by the governor and confirmed by the senate for two years; (*b*) makes tours of inspection; (*e*) prepares and distributes blank forms; (*f*) receives reports from county superintendents; (*g*) makes annual reports to the governor; (*h*) is a trustee of the University of Tennessee and of the State Agricultural College; (*i*) prescribes mode of examining and licensing teachers and their necessary qualifications; (*l*) may appoint persons in each county to visit schools.

Texas: (*a*) The secretary of the State board of education performs the duties of a superintendent of public instruction.

Vermont: (*a*) State superintendent of education, appointed by the legislature for two years; (*b*) visits all parts of the State, lectures and holds teachers' institutes; (*e*) prepares blank forms; (*f*) receives reports from town superintendents; (*g*) makes reports to the legislature.

Virginia: (*a*) State superintendent of public instruction, appointed by the legislature for four years; (*b*) visits free schools of State; (*c*) apportions money appropriated by the State; (*d*) construes school law; (*e*) prepares blank forms; (*f*) receives reports from county superintendents; (*g*) makes reports to State board of education.

West Virginia: (*a*) State superintendent of public instruction, elected by the people for four years; (*c*) signs requisitions for payment of county superintendents; (*d*) construes the school law; (*e*) prepares and distributes blank forms; (*f*) receives reports and collects statistics; (*g*) makes annual reports to the governor; (*h*) is president of the board of regents of State normal schools and member of the board of the school fund; (*i*) has power to revoke State licenses and normal diplomas; (*l*) appoints institute instructors.

WISCONSIN: (*a*) State superintendent of public instruction, elected by the people for two years; (*b*) visits counties and delivers addresses and supervises institute work; (*c*) apportions school revenues; (*d*) hears appeals; (*f*) receives reports from county and city superintendents; (*g*) makes reports to the governor; (*h*) is member of board of regents of State university and normal schools; (*i*) issues State certificates; (*k*) recommends text books.

II.—STATE BOARD OF EDUCATION.

Composition and duties.

INDEX.

a. Composition.
b. General supervision.
c. Relation to school property or school funds.
d. Judicial functions.
e. Power of appointment.
f. Power over text books and course of study.
g. Prepares blank forms.
h. Prepares questions for examination of teachers.
i. Examines candidates for State licenses and issues the same.
k. Receives reports.
l. Makes reports.
m. Miscellaneous.

CALIFORNIA: (*a*) State board of education, composed of the governor, State superintendent, principal of State normal school, and six county superintendents; (*b*) adopts rules and regulations for government of public schools and makes rules and establishes a standard of proficiency for the examination of teachers; (*f*) prescribes course of study and text books; (*i*) grants life licenses to teachers on recommendation of the board of examination, and may revoke the same: (*a*) also, State board of examination, composed of the State superintendent and four teachers holding State licenses appointed by him; (*i*) grants State licenses valid for two, three, four, and six years, and may revoke the same.

COLORADO: (*a*) Composed of the superintendent of public instruction, secretary of state, and attorney general; (*b*) makes rules and regulations for the government of the schools; (*i*) examines candidates for State license and issues the same.

CONNECTICUT: (*a*) Composed of the governor, lieutenant governor, and four persons appointed by the general assembly; (*b*) general supervision of school interests of the State; (*e*) appoints a secretary who acts as State superintendent; (*f*) prescribes text books; (*g*) prescribes blanks; (*l*) reports annually to the general assembly.

DELAWARE: (*a*) Composed of the secretary of state, auditor of state, and the president of Delaware College; (*d*) settles controversies between school officers; (*f*) prescribes text books; (*g*) issues blank forms for use of teachers.

FLORIDA: (*a*) Composed of the superintendent of public instruction, secretary of state, and attorney general; (*c*) has charge of school lands and funds; (*d*) hears appeals; (*e*) appoints county boards; (*m*) audits accounts of State superintendent.

GEORGIA: (*a*) Composed of the governor, attorney general, comptroller general, secretary of state, and State school commissioner; (*c*) holds property, can sue and be sued; (*d*) hears appeals from the State school commissioner.

INDIANA: (*a*) Composed of the governor, State superintendent, president of State university, president of Purdue University, president of State Normal School, and superintendents of the three largest cities of the State; (*e*) appoints trustees for the State university and visitors to the State Normal School; (*h*) prepares questions for examination of teachers; (*i*) examines candidates for State license and issues certificates to them; (*m*) commissions high schools to send pupils to the State university and issues instructions to county superintendents.

KANSAS: (*a*) Composed of the superintendent of public instruction, chancellor of State university, principal of State normal school, and president of State Agricultural

College; (*i*) examines candidates for State license, and issues the same; issues certificates to conductors of normal institutes.

Kentucky: (*a*) State board of education, composed of the superintendent of public instruction, secretary of state, attorney general, and two professional educators; (*b*) makes rules and regulations for the government of the schools; (*f*) recommends text books and course of study: (*a*) also, State board of examiners, composed of State superintendent and two teachers appointed by him; (*i*) examines candidates and issues State licenses.

Louisiana: (*a*) Composed of the State superintendent and six division superintendents; (*b*) makes rules and regulations for the government of the schools; (*e*) appoints parish, city, town, and district directors; (*f*) prescribes course of study and recommends uniform series of text books; (*m*) enforces the law admitting children into the schools without regard to race, color, or previous condition.

Maryland: (*a*) Composed of the governor, principal of State Normal School, and four persons appointed by the governor; (*b*) general supervision; (*d*) construes law and hears appeals; (*e*) appoints superintendent of public instruction; (*g*) prepares blank forms; (*i*) issues State licenses; (*k*) receives reports; (*l*) publishes an annual report; (*m*) examines county examiners.

Massachusetts: (*a*) Composed of the governor, lieutenant governor, and eight persons appointed by the governor, one retiring each year; (*b*) has care and management of the school system, subject to enactments of the legislature; (*l*) makes annual reports to the legislature.

Michigan: (*a*) Composed of the superintendent of public instruction and of three members elected by the people; (*h*) prepares questions for examination of teachers; (*i*) issues State licenses; (*m*) controls the State Normal School.

Mississippi: (*a*) Composed of the State superintendent, secretary of state, and attorney general; (*d*) hears appeals; (*e*) appoints and suspends county superintendents; (*m*) audits claims against the school funds.

Missouri: (*a*) Composed of the governor, State superintendent, secretary of state, and attorney general; (*c*) invests and has care of the State school funds.

Nevada: (*a*) Composed of the governor, superintendent of public instruction, and surveyor general; (*b*) devises plans for the improvement of the schools, its powers being chiefly advisory; (*c*) supervises the apportionment of school revenue made by the State superintendent; (*f*) prescribes text books; (*i*) issues State certificates.

New Jersey: (*a*) Composed of the governor, secretary of state, attorney general, comptroller, president of senate, speaker of assembly, treasurer and trustees of State Normal School; (*b*) general supervision; prescribes rules and regulations for carrying the school law into effect; (*c*) has charge of the permanent State investments for school purposes; (*d*) decides appeals from decisions of the State superintendent; (*e*) appoints the State superintendent and county superintendents; (*k*) receives reports from the State superintendent; (*l*) makes annual report to the legislature; (*m*) prescribes rules for holding teachers' institutes.

North Carolina: (*a*) Composed of the governor, lieutenant governor, secretary, treasurer, and auditor of state, and superintendent of public instruction; (*b*) makes rules and regulations for the government of the schools; (*c*) holds title to the swamp lands of the State, and applies proceeds of sale of same to school purposes; has charge of the permanent school fund; (*e*) appoints boards of directors and teachers for the State normal schools; (*f*) recommends text books; (*m*) organizes and controls the State normal schools.

Oregon: (*a*) Composed of the governor, secretary of state, and State superintendent; (*b*) makes general rules and regulations for the government of the schools; (*f*) prescribes text books and course of study; (*i*) examines and licenses teachers, and issues State and life licenses.

Rhode Island: (*a*) Composed of the governor, lieutenant governor, and six persons elected by the general assembly; (*b*) has general supervision of school affairs;

(*d*) has power to remit fines and penalties under the school law; (*e*) appoints the commissioner of public schools, who acts as secretary to the board: (*i*) examines teachers and grants licenses; (*k*) receives annual reports from the commissioner; (*l*) makes annual reports to the general assembly; (*m*) members are trustees of the State Normal School.

SOUTH CAROLINA: (*a*) Composed of the State superintendent and four members appointed by the governor: (*f*) prescribes text books and course of study; (*i*) issues State licenses.

TENNESSEE: (*a*) Composed of the governor and six persons appointed by him; (*b*) not charged with any duties in connection with the public schools: (*m*) has charge and control of the State Normal College and makes arrangements for opening normal schools.

TEXAS: (*a*) Composed of the governor, comptroller, and secretary of state; (*b*) has general supervision of schools; deals directly with the teachers and local school officers; (*e*) may appoint a secretary, if necessary, who shall act as State superintendent.

VIRGINIA: (*a*) Composed of the governor, superintendent of public instruction, and attorney general; (*c*) controls the State school fund; (*d*) decides appeals from the State superintendent; (*f*) secures uniformity in text books; (*l*) appoints and removes city and county superintendents and district trustees.

III.—CHIEF COUNTY OFFICER.

His appointment, duties, &c.

INDEX.

a. Title, mode of appointment, and term.
b. Examination and licensing of teachers.
c. Visitation, institutes.
d. Reports.
e. Judicial functions.
f. Relations to county board.
g. Relations to school moneys.
m. Miscellaneous.

ALABAMA: (*a*) County superintendent, appointed by the State superintendent for two years; (*c*) visits schools and holds institutes; (*d*) makes annual report to State superintendent; (*f*) member of county board of examiners; (*g*) disburses school revenue for county and reports same with vouchers to State superintendent.

ARKANSAS: (*a*) County examiner, appointed by the county court for two years; (*b*) examines and licenses teachers; may revoke licenses; (*c*) holds county institutes; (*d*) receives reports from directors and makes annual reports to the State superintendent.

CALIFORNIA: (*a*) County superintendent, elected by the people for two years; (*b*) issues temporary certificates to teachers; (*c*) visits each school once a year; presides over county institutes; (*d*) makes reports to the State superintendent; (*f*) chairman of county board of examination, if he holds a first grade license; (*g*) apportions school money quarterly; (*m*) appoints trustees, in case of failure to elect.

COLORADO: (*a*) County superintendent, elected by the people for two years; (*b*) examines and licenses teachers; (*c*) visits all schools once each quarter; (*d*) makes reports to the State superintendent and to the county commissioners; (*g*) apportions school moneys quarterly; (*m*) ascertains boundaries of districts, examines accounts of same, and fills vacancies in district boards.

DELAWARE: (*a*) County superintendent, appointed annually by the governor; (*c*) visits schools; (*d*) makes reports to the general assembly; (*m*) supplies blank forms and collects information.

FLORIDA: (*a*) County superintendent, appointed by the governor for two years; (*b*) may examine and license teachers, if authorized by county board of public instruction; (*c*) visits and inspects schools; (*d*) makes annual reports to the State superintendent; (*e*) decides disputed questions, and refers same to the board; (*f*) secretary and agent of county board of public instruction.

GEORGIA: (*a*) County school commissioner, elected by county board of education for four years; (*b*) examines and licenses teachers, and may revoke licenses; (*c*) visits schools twice yearly; (*d*) makes annual reports to State school commissioner and to grand jury of county; (*f*) is secretary of the county board; (*g*) disburses school revenue on order of county board.

ILLINOIS: (*a*) County superintendent, elected by the people for four years; (*b*) examines and licenses teachers; (*c*) visits schools and holds institutes; (*d*) makes reports to the State superintendent and to the county board; (*g*) disburses school revenue; (*m*) has charge of school land and county school fund.

INDIANA: (*a*) County superintendent, appointed by township trustees for two years; (*b*) examines and licenses teachers, and may revoke licenses; (*c*) visits and inspects schools and holds institutes; (*d*) makes reports to State superintendent; (*e*) decides appeals from decisions of trustees; (*f*) president of county board.

IOWA: (*a*) County superintendent, elected by the people for two years; (*b*) examines and licenses teachers, and may revoke licenses; (*c*) visits schools and holds institutes; (*d*) makes reports to State superintendent; (*e*) decides appeals from decisions of directors.

KANSAS: (*a*) County superintendent, elected by the people for two years; (*c*) holds annually a county normal institute; (*d*) receives reports from school district clerks, and makes annual reports to the State superintendent and monthly reports of institute funds to the county treasurer; (*e*) decides appeals from decisions of district boards; (*f*) is member of county examining committee; (*g*) apportions State and county funds; (*m*) appoints appraisers of school lands and fills vacancies in district boards.

KENTUCKY: (*a*) County commissioner, appointed by the county judge and justices of the peace for two years; (*c*) visits all schools at least once a year; (*d*) makes reports to the State superintendent; (*e*) decides disputes regarding school affairs; (*f*) member of county board of examiners; (*m*) lays off school districts, provides teachers with regulations, &c., and may remove teachers for not enforcing the same.

MARYLAND: (*a*) County examiner, appointed by the county school board for two years; (*b*) examines teachers; (*c*) visits and inspects schools and holds institutes; (*f*) is secretary of county school board.

MINNESOTA: (*a*) County superintendent, elected by the people for two years; (*b*) examines and licenses teachers; may revoke licenses; (*c*) visits schools; (*d*) makes quarterly reports to county auditor and annual reports to State superintendent; (*m*) distributes blank forms.

MISSISSIPPI: (*a*) County superintendent, appointed by State board of education for two years; (*b*) examines and licenses teachers, and may revoke licenses; (*c*) visits schools; (*d*) makes annual reports to State superintendent and the board of supervisors; (*f*) superintendent of city schools of his county; (*m*) advises trustees as to their duties.

MISSOURI: (*a*) County school commissioner, elected by the people for two years; (*b*) examines and licenses teachers, and may revoke licenses; (*d*) makes statistical reports to State superintendent; (*m*) supplies districts with copies of the school law and blank forms.

NEBRASKA: (*a*) County superintendent, elected by the people for two years; (*b*) examines and licenses teachers; (*c*) visits schools, delivers lectures, and holds institutes; (*g*) apportions county school moneys; (*m*) forms new districts; appoints school officers and locates school-houses where districts fail to do so.

NEVADA: (*a*) County superintendent, elected by the people for two years; (*c*) visits each school yearly and holds institutes; (*d*) makes annual reports to the State superintendent; (*f*) is chairman of county board of examiners; (*g*) apportions school moneys quarterly; (*m*) appoints trustees, in case of failure to elect; issues warrants on county treasurer for payment of teachers.

NEW JERSEY: (*a*) County superintendent, appointed by State board of education for three years; (*b*) examines and licenses teachers; (*c*) visits schools; (*d*) makes reports

to the State superintendent; (e) decides disputes under the school law; (g) apportions school money to townships and districts.

New York: (a) From one to four school commissioners in each county, elected by the people every three years; (b) examines and licenses teachers, and can revoke licenses; (c) visits schools and attends institutes; (d) makes annual reports to State superintendent; (e) decides disputed questions in his district; (g) apportions school moneys.

North Carolina: (a) County examiner, appointed by the county board for two years; (b) examines and licenses teachers; (d) makes annual reports to the State superintendent and to the county board; (m) may recommend the revocation of licenses to the county board.

Oregon: (a) County superintendent, elected by the people for two years; (b) examines and licenses teachers; (c) visits schools; (d) makes annual reports to the State superintendent; (g) apportions school moneys; (m) has charge of school lands; divides county into school districts.

Pennsylvania: (a) County superintendent, elected by the school directors for three years; (b) examines and licenses teachers; (c) visits schools and holds institutes; (d) makes annual reports to the State superintendent; (m) must hold a diploma from a college or normal school, or a certificate from the State superintendent.

South Carolina: (a) County school commissioner, elected by the people for two years; (c) visits and inspects schools; (d) makes reports to the State superintendent; (f) is chairman of the county board of examiners; (g) apportions county school revenue.

Tennessee: (a) County superintendent, appointed by the county court for two years; (b) examines and licenses teachers; (c) visits schools; (d) makes annual reports to the State superintendent; (g) approves warrants drawn by directors for school moneys; (m) secures uniformity in text books.

Vermont: (a) County examiner, chosen by town superintendents for one year; (b) examines and licenses teachers.

Virginia: (a) County superintendent, appointed by State board of education for four years; (b) examines and licenses teachers; (c) visits and inspects schools; (e) decides appeals and disputes; (f) is president of county school board; (g) apportions school revenues in his county.

West Virginia: (a) County superintendent, elected by the people for two years; (c) assists at county institutes; (d) makes annual reports to the State superintendent; (f) is member of county board of examiners; (g) apportions school revenues; (m) distributes blank forms.

Wisconsin: (a) County superintendent, elected by the people for two years; (b) examines and licenses teachers, and may revoke licenses; (c) visits and inspects schools and holds institutes; (d) makes reports to the State superintendent.

IV.—COUNTY BOARDS.

Their composition and duties.

INDEX.

a. Title and composition.
b. Examination, licensing, and employment of teachers.
c. Power to regulate schools, course of study, and text books.
d. Power to locate and build school houses.
e. Relation to school taxes, &c.
f. Make reports.
m. Miscellaneous.

California: (a) Composed of county superintendent and from three to five teachers holding first grade certificates appointed by him; (b) examines and licenses teachers.

Florida: (a) County board of public instruction, appointed by State board for four years; county superintendent is secretary; (b) employs teachers on recommenda-

tion of trustees; (*c*) grades schools and makes rules and regulations; (*d*) locates and builds school-houses; (*e*) orders levy of local taxes, receives and pays out school money; (*m*) provides separate schools for the different races.

GEORGIA: (*a*) County board of education, five persons, chosen by the grand jury; county superintendent is secretary; (*b*) licenses and employs teachers; (*c*) prescribes text books; (*d*) locates schools and lays off subdistricts; (*m*) chooses county school commissioner.

INDIANA: (*a*) County board of education, composed of county superintendent and the township trustees and the presidents of the city and town school boards; (*c*) adopts text books; (*m*) meets semiannually and considers the general wants and needs of the schools.

KANSAS: (*a*) County board of examiners, composed of the county superintendent and two persons appointed by the county commissioners; (*b*) examines and licenses teachers, and may revoke licenses.

KENTUCKY: (*a*) County board of examiners, composed of the county commissioner and two persons selected by him; (*b*) examines and licenses teachers; (*c*) selects a uniform series of text books.

LOUISIANA: (*a*) Parish board of school directors, five or nine members, appointed by State board of education for four years; (*b*) examines by committee, licenses and employs teachers, and may dismiss them for cause; (*c*) prescribes rules for the government of schools and dismisses pupils for cause; (*d*) locates and builds school-houses, and provides furniture, apparatus, &c.; (*e*) levies parish school tax and apportions school revenues; (*m*) divides the parish into districts; appoints visiting trustees.

MARYLAND: (*a*) Board of county school commissioners, appointed by the judge of the circuit court for two years; (*b*) appoints the county superintendent and confirms the appointment of teachers; (*c*) selects and purchases uniform text books; (*d*) divides the county into districts and builds and repairs school-houses; (*e*) fixes amount of county tax, subject to approval of county commissioners; (*f*) makes yearly report to State board.

MISSISSIPPI: (*a*) County board of school directors, elected by the parents or guardians of the school children of the county; (*m*) governs the schools of the county, each county being a school district.

NEVADA: (*a*) County board of examination, composed of the county superintendent and two persons appointed by him; (*b*) examines and licenses teachers.

NEW JERSEY: (*a*) County board of examiners, composed of the county superintendent and two teachers selected by him: (*b*) examines and licenses teachers.

NORTH CAROLINA: (*a*) County board of education, composed of the five members of the board of county commissioners and the register of deeds; (*c*) has supervision of the schools of the county; (*e*) levies local school taxes; (*f*) makes semiannual reports to the superintendent of public instruction; (*m*) divides county into districts, and appoints committeemen for same; appoints county examiner.

OHIO: (*a*) County board of examiners, three members, appointed by the probate judge, one member being appointed each year; (*b*) examines and licenses teachers.

SOUTH CAROLINA: (*a*) County board of examiners, composed of the county commissioner and two persons appointed by the State board for two years; (*b*) examines and licenses teachers.

TEXAS: (*a*) County board of examiners appointed annually by the county judge; (*b*) examines teachers and recommends for licenses to the county judge.

VIRGINIA: (*a*) County school board, composed of all the district trustees, with the county superintendent as president; (*e*) estimates the amount of money needed for school purposes; (*m*) examines yearly the records and vouchers of the district boards.

WEST VIRGINIA: (*a*) County board of examiners, composed of the county superintendent and two teachers chosen by presidents of the district boards; (*b*) examines and licenses teachers.

V.—TOWNSHIP AND DISTRICT OFFICERS.[1]

Their duties, &c.

INDEX.

a. Title, appointment, and term.	*e.* Relation to school property.
b. Employment of teachers.	*f.* Relation to school money.
c. Power to regulate schools.	*g.* Make reports.
d. Visitation of schools.	*m.* Miscellaneous.

ALABAMA: (*a*) Township superintendents, appointed by the county superintendent; (*b*) employ and contract with teachers; (*d*) visit schools of their townships; (*m*) certify to correctness of teachers' reports.

ARKANSAS: (*a*) Board of district school directors, three members, elected by the people for three years; (*b*) employs and contracts with teachers; (*c*) takes charge of the school affairs of the district; (*d*) visits schools; (*g*) makes reports to the county examiner.

CALIFORNIA: (*a*) Board of district school trustees, three members, elected by the people, one each year for three years; each county, city, or incorporated town is a district; (*b*) employs and contracts with teachers; (*c*) enforces use of text books and course of study prescribed by State board; suspends and expels pupils; (*d*) visits each school once each term; (*e*) controls school property; (*f*) receives and disburses school money; (*g*) makes reports to county and State superintendents; (*m*) furnishes books to indigent children; appoints school census marshals.

COLORADO: (*a*) District board of directors, three or six members, elected, one-third yearly, for three years; (*b*) employs teachers; (*e*) has control of school property, buys and sells the same, fixes sites, and builds school-houses; (*f*) levies local school taxes on vote of people.

CONNECTICUT: (*a*) District committee, three members; (*b*) employs teachers; (*m*) takes charge of the school affairs of the district.

DELAWARE: (*a*) District committee, three members, elected, one yearly, for three years; (*b*) employs and contracts with teachers; (*c*) sees that schools are kept open as long as the funds will permit; (*e*) selects sites and builds school-houses; (*f*) assesses and levies the annual school tax.

FLORIDA: (*a*) District school trustees, appointed for four years by the county board of education; (*b*) recommend teachers to the county board; (*e*) have charge of school property.

GEORGIA: (*a*) Three school trustees for each subdistrict, appointed by the county board of education; (*b*) recommend teachers to county board; (*d*) supervise schools; (*f*) make annual reports to county board.

ILLINOIS: (*a*) Three township trustees, elected by the people for three years; (*e*) hold title of school property; (*f*) hold and distribute funds of districts and money received from county superintendent; (*g*) make reports to county superintendent: also, (*a*) three school directors in each district, elected by the people for three years; (*b*) hire teachers; (*c*) prescribe course of study; (*e*) build school-houses; (*f*) levy local school taxes and disburse funds by order on trustees.

INDIANA: (*a*) One township trustee elected by the people for two years; (*b*) employs teachers; (*c*) establishes graded schools; (*e*) builds school-houses and has care of school property; (*f*) orders levy of local school taxes and pays out and accounts for school moneys; (*g*) makes reports to county commissioners and county superintendent; (*m*) takes school census.

IOWA: (*a*) Township board of directors, three or more, elected by the people; (*b*) employs teachers, and may dismiss them; (*c*) prescribes course of study and text

[1] District means a part of a town or township, unless otherwise stated.

books; can suspend or expel pupils; (*d*) visits schools; (*e*) locates school-houses, and can divide districts; (*f*) levies taxes.

KANSAS: (*a*) District board, three members, elected by the people for three years; (*b*) employs and contracts with teachers; may dismiss them for cause; (*c*) regulates schools, suspends pupils, and requires uniformity in text books; (*d*) visits school once each term; (*e*) has care of school property; (*f*) receives and disburses school money; (*g*) makes reports to county superintendent.

KENTUCKY: (*a*) District trustee, elected by votes of the district for one year; district must not be more than four miles square; (*b*) employs, contracts with, and removes teachers; (*c*) enforces regulations for government of schools; (*d*) visits schools once a month; (*e*) holds, buys, and sells school property, and builds or provides school-houses; (*f*) levies and collects local school taxes; (*g*) makes reports.

LOUISIANA: (*a*) Auxiliary visiting trustees, appointed for the districts by the parish board; (*d*) visit the schools; (*g*) make quarterly reports to the parish board.

MAINE: (*a*) Town school committees or supervisors; (*b*) examine and license teachers, and may dismiss teachers; (*c*) grade schools, prescribe course of study and text books: (*d*) inspect schools.

MARYLAND: (*a*) Three trustees for each district, appointed by the county board; (*b*) employ teachers; (*c*) have power to expel pupils; (*c*) take care of school property.

MASSACHUSETTS: (*a*) Town school committee, three persons; (*b*) examines and licenses teachers; (*c*) superintends the public schools; (*d*) visits schools; (*f*) apportions school money; (*g*) makes report to town.

MICHIGAN: (*a*) District board, three or six members, elected one-third yearly for three years; (*b*) employs teachers; (*c*) prescribes course of study and text books; (*e*) builds school-houses; (*f*) manages school funds; determines yearly tax.

MINNESOTA: (*a*) District board of trustees, three members; district may include a township; (*b*) employs and contracts with teachers; (*c*) may expel pupils for cause; (*e*) purchases sites and provides houses when ordered by school meetings; (*f*) levies taxes if district neglects to do so.

MISSISSIPPI: (*a*) Local trustees, three for each school, elected yearly by patrons of school; (*b*) select teachers; (*c*) arbitrate between teachers and pupils; (*d*) visit schools monthly; (*e*) protect school property.

MISSOURI: (*a*) District board, three or six members, elected one-third yearly for three years; (*b*) employs teachers; (*c*) makes rules for organization, grading, and government of schools, and may expel pupils; (*d*) visits schools; (*e*) has custody of school property; (*f*) levies district school tax; (*m*) takes school census.

NEBRASKA: (*a*) District (township?) board, three or six members, elected for three years; (*b*) employs teachers (?); (*c*) grades schools and prescribes course of study; (*e*) has custody of school property, and purchases or leases sites, and builds school-houses; (*f*) manages school funds and reports taxes.

NEVADA: (*a*) District board of school trustees, three or five members, elected by the people for four years; (*b*) district equivalent to township; employs, contracts with, and may dismiss teachers; (*e*) locates and builds or provides school-houses, when so ordered by vote of the district; (*f*) levies local school taxes on vote of the people; takes enumeration of school children.

NEW HAMPSHIRE: (*a*) Town school committee, three members, elected by the people or appointed by selectmen for one year; (*c*) regulates schools, prescribes rules, course of study, and text books; (*d*) visits schools; (*g*) makes annual reports to the superintendent of public instruction: also, (*a*) district prudential committee, one person elected by the people for one year; (*b*) employs teachers; (*e*) has charge of school property.

NEW JERSEY: (*a*) Three school trustees, elected by districts for three years; women eligible; (*b*) employ teachers; (*e*) erect and repair school-houses; (*f*) preserve financial records.

NEW YORK: (a) One or three district school trustees, elected annually by the people; (b) employ and contract with teachers; (c) regulate schools; prescribe course of study; may expel pupils; (d) visit schools; (e) build or provide school-houses; (f) levy local school taxes; (g) make annual report to school commissioners; (m) take school census; may be teachers themselves, and cannot employ near relatives except by vote of the district.

NORTH CAROLINA: (a) District school committee, three members, appointed by the county board for three years; (b) employs teachers; (c) supervises schools, under direction of the county board; (d) visits schools and corrects abuses; (e) holds and controls school property, selects sites, and builds school-houses; (f) disburses school moneys by orders on the county treasurer; (g) makes reports to the county board; (m) examines and approves reports of teachers.

OHIO: (a) District board of education, composed of a clerk and two directors; the clerks of all the districts of a township form, with the township clerk, a township board; (b) employs teachers; (c) prescribes course of study and text books; (e) builds and repairs school-houses; (f) levies local school taxes.

OREGON: (a) Three district directors, elected one each year for three years; district a division of a county; (b) employ and contract with teachers; (c) aid teachers in discipline of the schools and secure uniformity in text books; (d) visit schools twice each term; (e) purchase sites and build and provide school-houses; (f) levy district school tax.

PENNSYLVANIA: (a) District board of school directors elected for three years; (b) employs teachers; (c) grades schools and prescribes course of study and text books; (d) visits schools; (e) establishes schools and builds houses; (f) levies taxes for schools and buildings; (g) publishes financial statement; (m) elects county superintendent.

RHODE ISLAND: (a) Town school committee, consisting of superintendent of schools and three or more members appointed by town, one-third yearly; also, one or three district trustees, elected annually; (f) the trustees hire teachers, subject to approval of the school committee; (c) rules and regulations for the management of schools made by the committee; length and times of school terms are fixed by the trustees; (d) visitation by school superintendent; (f) trustees make out tax bills for the district; (g) trustees make reports to the committee.

SOUTH CAROLINA: (a) Board of school district trustees, three members, appointed by county board of examiners; (b) employs teachers, and may remove them for cause; (c) can suspend or expel pupils; (d) visits schools.

TENNESSEE: (a) Three district directors elected, one annually for three years; district subdivision of county; (b) employ and may dismiss teachers; (c) keep separate schools for white and colored children; may dismiss pupils; enforce rules and regulations; (d) visit schools; (e) control and manage school property; (f) disburse school moneys; (g) make annual reports to the county superintendent.

TEXAS: (a) Three community trustees appointed by the county judge on request of persons forming a school community; (b) employ teachers; (c) have the general control and management of the schools; (m) approve the selection of text books made by teachers.[1]

VERMONT: (a) Town superintendents, elected annually by the people; (b) license teachers: also, (a) District prudential committee, one person elected by the people; (b) employs teachers; (e) has care of school property.

VIRGINIA: (a) District school board; district corresponds to township; (b) employs teachers, and may dismiss them; (c) may suspend or expel pupils; (d) visits schools; (e) controls and manages school property; (f) estimates funds necessary for schools.

WEST VIRGINIA: (a) District (township) board of education, five members, elected by the people for two years; (b) employs and contracts with teachers; (c) regulates schools as to location, number, and length of term; (d) has general supervision of

[1] The school system of Texas seems to be a purely permissive one.

schools; (e) holds and controls school property; (f) disburses school money by orders upon the sheriff, and levies district taxes; (m) may appoint trustees for subdistricts.

WISCONSIN: (a) School district board, three members, elected one yearly for three years; (b) employs teachers; (c) regulates schools, suspends and expels pupils, prescribes text books; (e) has charge of school property, builds houses, &c.; (f) may determine amount of school taxes, if district meeting fails to do so.

NOTE.—In most States, cities and large towns have independent jurisdiction over their schools, and their officers perform the functions usually performed by township and district officers.

VI.—EXAMINATION, APPOINTMENT, AND SUPERVISION OF TEACHERS.

INDEX.

a. By whom examined and licensed.
b. By whom selected and appointed.
c. By whom supervised.

ALABAMA: (a) County board of examiners, consisting of county superintendent and two teachers selected by him; (b) township superintendents; (c) township superintendents, once or twice yearly.

ARKANSAS: (a) County examiner; State license by the State superintendent; (b) district board of school directors; (c) school directors.

CALIFORNIA: (a) County or city board of examination; State license by the State board of education; (b) district board of trustees; (c) county superintendent and district trustees.

COLORADO: (a) County superintendent; State license by the State board of education; (b) district board of directors; (c) county superintendent.

CONNECTICUT: (a) Board of school visitors, six or nine persons, elected, one-third yearly; (b) school district committee, not more than three persons, chosen annually; (c) acting visitors, twice each term; they are members of board of school visitors.

DELAWARE: (a) State superintendent; (b) district committee; (c) State and county superintendent.

FLORIDA: (a) License granted by county board of public instruction to persons examined by county superintendent and to graduates of department of teaching; State license by State superintendent; (b) county board of public instruction, on recommendation of the school trustees; (c) county superintendent, every three months.

GEORGIA: (a) Examined by county school commissioner (superintendent); license granted by county board of education; (b) county board of education; (c) county school commissioner, twice yearly.

ILLINOIS: (a) County superintendent; State license by State superintendent; (b) district school directors; (c) county superintendent, yearly, if so directed by county board.

INDIANA: (a) County superintendent; State license by State board of education; (b) township trustees; (c) county superintendent, once yearly.

IOWA: (a) County superintendent; (b) district board of directors; (cities are independent districts; the township district board consists of one subdirector from each subdistrict; subdirectors have charge of their own schools under direction of the board); (c) county superintendent, once each term, giving half a day at each visit.

KANSAS: (a) County board of education; State license by State board of education; (b) school district board; (c) county superintendent, occasionally.

KENTUCKY: (a) County board of examiners; State license by State board; (b) district trustee; (c) district trustee.

LOUISIANA: (a) Examining committee, appointed by parish board; (b) parish board; (c) visiting trustees.

MAINE: (a) Superintending school committee of towns; (b) superintending school committee; (c) superintending school committee.

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MARYLAND: (*a*) County examiner or State Normal School: State license by the State board of education; (*b*) district trustees, subject to confirmation by county school board; (*c*) county examiner, twice yearly.

MASSACHUSETTS: (*a*) Town school committee; (*b*) town school committee: some towns elect prudential committees, consisting of one person from each district; (*c*) town school committee.

MICHIGAN: (*a*) Township superintendent: State license by State board of education; (*b*) school district board; (*c*) township superintendents.

MINNESOTA: (*a*) County superintendent; (*b*) district trustees; (*c*) county superintendent.

MISSISSIPPI: (*a*) County superintendent; (*b*) local trustees, or, in their default, county superintendent; (*c*) local trustees, once yearly.

MISSOURI: (*a*) County school commissioner; (*b*) district directors, three in number, one elected yearly for three years; (*c*) county school commissioner.

NEBRASKA: (*a*) County superintendent: State license by State superintendent; (*b*) district board; county superintendent divides county into districts; (*c*) county superintendent.

NEVADA: (*a*) County board of examination; (*b*) district trustees; (*c*) county superintendent.

NEW HAMPSHIRE: (*a*) Town school committees and boards of education; (*b*) district prudential committees and boards of education; (*c*) town school committees, boards of education, and superintendents.

NEW JERSEY: (*a*) County superintendent; (*b*) district trustees; each city a district; country districts, enough territory for one school; (*c*) county superintendent, twice yearly.

NEW YORK: (*a*) School commissioners; State license by State superintendent; (*b*) district trustees; (*c*) school commissioners, once or twice a year.

NORTH CAROLINA: (*a*) County examiner; (*b*) district school committee; (*c*) school committee.

OHIO: (*a*) County board of examiners; State license by State board of examiners; (*b*) directors of subdistrict; (*c*) no supervision.

OREGON: (*a*) County superintendent; (*b*) district directors (?); (*c*) county superintendent.

PENNSYLVANIA: (*a*) County superintendent; State license by State superintendent; (*b*) district board of school directors; every township, borough, and city a district; (*c*) county superintendent.

RHODE ISLAND: (*a*) Town school committee; (*b*) district trustees, subject to approval of the committee; (*c*) school committee.

SOUTH CAROLINA: (*a*) County board of examiners; State license by State board of education; (*b*) board of district trustees; (*c*) county school commissioner.

TENNESSEE: (*a*) County superintendent; (*b*) district directors; (*c*) county superintendent.

TEXAS: (*a*) County board of examiners; (*b*) community trustees; (*c*) community trustees (?).

VERMONT: (*a*) County examiners, who are appointed by the town superintendents at yearly meetings; (*b*) district prudential committee; (*c*) town superintendents, once yearly.

VIRGINIA: (*a*) County superintendent; (*b*) district school board; district corresponds to township; (*c*) county superintendent.

WEST VIRGINIA: (*a*) County board of examiners; (*b*) district board of education; (*c*) district board and subdistrict trustees.

WISCONSIN: (*a*) County superintendent; State license by State superintendent and State board of education; (*b*) district board; (*c*) county superintendent.

NOTE.—In most States diplomas of State normal schools are equivalent to State licenses.

VII.—DURATION OF SCHOOLS.

Attendance thereon and course of study.

INDEX.

a. How long local authorities are compelled to maintain schools.
b. Minimum course of study prescribed.
c. Attendance.

ALABAMA: (a) Twelve weeks.

CALIFORNIA: (a) Six months to secure appropriation; (b) reading, writing, spelling, arithmetic, geography, history of the United States, physiology, natural history, drawing, and music; (c) compulsory, but law not enforced.

COLORADO: (a) Three months; (b) orthography, reading, writing, arithmetic, grammar, geography, history of the United States, physiology, and the elements of natural science.

CONNECTICUT: (a) Thirty weeks in districts of twenty-four or more school children; twenty-four weeks in lesser districts; (c) children from eight to fourteen must attend three months each year.

DELAWARE: (a) As long as funds hold out.

FLORIDA: (a) Three months yearly, or forfeit appropriation.

GEORGIA: (a) Three months yearly, or forfeit appropriation; (b) State and county limited to elementary English branches.

ILLINOIS: (a) Six months yearly; (b) orthography, reading, penmanship, arithmetic, English grammar, geography, history of the United States.

INDIANA: (a) No minimum; (b) orthography, reading, writing, arithmetic, grammar, geography, physiology, and history of the United States.

IOWA: (a) Twenty-four weeks; (b) common branches.

KANSAS: (a) Three months, or forfeit appropriation; (b) orthography, reading, writing, grammar, geography, arithmetic, and other English branches in the discretion of the district board; (c) compulsory for all between eight and fourteen who live within two miles of a school-house.

MAINE: (c) Children from six to fifteen must attend twelve weeks.

MARYLAND: (a) Ten months yearly in at least one school in each district.

MASSACHUSETTS: (c) Children between eight and twelve must attend twenty weeks each year.

MICHIGAN: (a) Nine months in districts of eight hundred children, five months in districts of thirty, and three months in lesser districts.

MINNESOTA: (a) Three months each year, or forfeit appropriation.

MISSISSIPPI: (a) Five months, provided local, State, and county tax does not amount to more than $15 on $1,000.

MISSOURI: (a) Generally four months; not less than thirty nor more than forty weeks in cities, towns, and villages.

NEBRASKA: (a) In order to draw public money, three months, if less than seventy-five pupils; six months, if less than two hundred pupils; nine months, if more than two hundred pupils.

NEVADA: (a) Six months each year, in order to obtain public money; (b) spelling, reading, grammar, arithmetic, geography, and physiology; (c) children between eight and fourteen years must attend sixteen weeks.

NEW HAMPSHIRE: (a) Optional; (c) all children between eight and fourteen must attend twelve weeks.

NEW JERSEY: (a) Nine months yearly; (c) all children between eight and fourteen must attend twelve weeks consecutively each year.

NEW YORK: (a) Twenty-eight weeks each year, or forfeit public money; (b) optional with the trustees.

NORTH CAROLINA: (*a*) Four months; (*b*) orthography, reading, penmanship, arithmetic, grammar, geography, and history of the United States.

OHIO: (*a*) Legal school year is twenty-four weeks.

OREGON: (*a*) Legal school year is sixty days; (*b*) orthography, reading, writing, arithmetic, grammar, geography, and history of the United States.

PENNSYLVANIA: (*a*) Not less than five months.

RHODE ISLAND: (*a*) Twenty-four weeks.

TENNESSEE: (*a*) Five months; (*b*) orthography, reading, writing, arithmetic, grammar, geography, geology of Tennessee, history of the United States, elements of agriculture.

VERMONT: (*a*) Towns must have twenty weeks, or forfeit school money; (*b*) reading, spelling, writing, arithmetic, grammar, history of the United States, and good behavior; (*c*) children from eight to fourteen must attend three months.

VIRGINIA: (*a*) Five months yearly; (*b*) reading, spelling, writing, arithmetic, geography, and grammar.

WEST VIRGINIA: (*a*) Four months; (*b*) orthography, reading, writing, arithmetic, grammar, history, and geography.

WISCONSIN: (*a*) Five months yearly, or forfeit share of school money; (*b*) common branches, including history of United States; (*c*) compulsory for all between seven and fifteen.

VIII.—FINANCIAL SYSTEMS.

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a. How State school revenue is produced.

b. How State school revenue is used.

c. What per cent. of teachers' salaries the State school revenue furnishes.

d. How local taxes are levied.

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ARKANSAS: (*a*) Tax permanently fixed by statute, and interest on permanent fund; (*b*) exclusively for tuition; (*d*) county tax by county court.

CALIFORNIA: (*a*) Tax permanently fixed by statute, and interest on permanent fund; (*c*) 98 per cent.; (*d*) county tax by county authorities; district tax by local vote.

COLORADO: (*a*) No State tax; (*d*) county tax by county commissioners; district tax by district board on vote of the people.

CONNECTICUT: (*a*) Tax permanently fixed by statute, and interest on permanent fund; (*b*) exclusively for tuition; (*c*) 43 per cent.; (*d*) town and district taxes by vote of the people.

DELAWARE: (*a*) Legislative appropriation; (*c*) 25 per cent.; (*d*) district tax by district committee.

FLORIDA: (*a*) Tax periodically fixed by statute; (*b*) for general school expenses; (*c*) 35 per cent.; (*d*) county tax by county board of public instruction.

GEORGIA: (*a*) Tax permanently fixed by statute; (*b*) exclusively for tuition; (*d*) county tax by a two-thirds vote of the electors.

ILLINOIS: (*a*) Tax periodically fixed by statute; (*b*) for general school expenses; (*c*) 27 per cent.; (*d*) district tax by district directors; a township tax for high school a county tax for county normal school.

INDIANA: (*a*) Tax permanently fixed by statute, and interest on permanent fund; (*b*) exclusively for tuition; (*c*) 76 per cent.; (*d*) township tax by township trustees.

IOWA: (*a*) No State tax; interest on permanent fund; (*d*) county tax by board of supervisors, township and district tax by electors and by board of directors.

KANSAS: (*a*) No State tax; (*d*) district tax by vote of electors.

KENTUCKY: (*a*) Tax permanently fixed by statute, and interest on permanent fund; (*b*) exclusively for tuition; (*d*) county tax by vote of the people, district tax by same

LOUISIANA: (*a*) Tax permanently fixed by statute, and interest on permanent fund (*c*) 86 per cent.; (*d*) parish tax by order of parish board.

MAINE: (*a*) Tax permanently fixed by statute, and interest on permanent fund; (*b*) for general school expenses; (*c*) 42 per cent.; (*d*) town tax by town assessors.

MARYLAND: (*a*) Tax permanently fixed by statute, and interest on permanent fund; (*b*) for general school expenses; (*c*) 75 per cent.; (*d*) county tax by county commissioners.

MASSACHUSETTS: (*a*) Legislative appropriations, and interest on permanent fund; (*c*) 39 per cent.; (*d*) town tax.

MICHIGAN: (*a*) No State tax; interest on permanent fund; (*d*) township tax by township supervisor, district tax by district board.

MINNESOTA: (*a*) No State tax; (*d*) district tax by vote of people, in independent districts by trustees.

MISSISSIPPI: (*a*) Liquor licenses, land redemptions, fines, and forfeitures; (*b*) exclusively for tuition and pay of county superintendents; (*d*) county tax by board of supervisors.

MISSOURI: (*a*) No State tax; interest on permanent fund; (*d*) district tax by board of district directors.

NEBRASKA: (*a*) Tax permanently fixed by statute, and interest on permanent fund; (*b*) exclusively for tuition; (*c*) 52 per cent.; (*d*) district tax by vote of the people.

NEVADA: (*a*) Tax permanently fixed by statuts, fines and escheats, and interest on permanent fund; (*b*) exclusively for tuition; (*c*) 78 per cent.; (*d*) county tax by county commissioners, district tax by vote of electors.

NEW HAMPSHIRE: (*a*) Interest on permanent fund; (*b*) not exclusively for tuition; (*d*) district tax by vote of the people.

NEW JERSEY: (*a*) Tax permanently fixed by statute, and interest on permanent fund; (*b*) not exclusively for tuition; (*c*) 91 per cent.; (*d*) township tax by township meeting, district tax by vote of the people,

NEW YORK: (*a*) Tax permanently fixed by statute, and interest on permanent fund; (*b*) not exclusively for tuition; (*c*) 58 per cent.; (*d*) district tax by district trustees.

NORTH CAROLINA: (*a*) Tax permanently fixed by statute; (*b*) for general school expenses; (*d*) county tax by board of commissioners.

OHIO: (*a*) Tax permanently fixed by statute, and income of school lands; (*b*) exclusively for tuition; (*c*) 46 per cent.; (*d*) district tax by district board.

OREGON: (*a*) Tax permanently fixed by statute, and interest on permanent fund; (*c*) 67 per cent.; (*d*) county tax by county authorities, district tax by district directors.

PENNSYLVANIA: (*a*) Legislative appropriation; (*c*) 20 per cent.; (*d*) district tax by district school directors.

RHODE ISLAND: (*a*) Legislative appropriation; (*b*) exclusively for tuition; (*c*) 36 per cent.; (*d*) district tax by district trustee, with approval of school meeting.

SOUTH CAROLINA: (*a*) Tax permanently fixed by statute; (*d*) no local taxes except in cities.

TENNESSEE: (*a*) Tax periodically fixed by statute; (*b*) not exclusively for tuition; (*d*) county tax by the county court.

TEXAS: (*a*) Poll tax, one-fourth of occupation and ad valorem taxes, interest on proceeds of school lands; (*d*) local boards of school directors levy local taxes.

VERMONT: (*a*) No State tax; (*d*) town tax by selectmen.

VIRGINIA: (*a*) Tax periodically fixed by statute, and interest on permanent fund; (*b*) salaries of teachers and superintendents; (*c*) 51 per cent.; (*d*) township tax by board of supervisors.

WEST VIRGINIA: (*a*) Tax periodically fixed by statute and interest on permanent fund; (*b*) exclusively for tuition; (*c*) 47 per cent.; (*d*) district tax by board of education.

WISCONSIN: (*a*) No State tax; interest of permanent fund; (*d*) district tax by district meeting.

IX.—ANALYSIS OF IMPORTANT PARTICULARS.

I. STATE SUPERINTENDENT.

(1) *Mode of appointment.*— (*a*) Elected by the people in Alabama, Arkansas, California, Colorado, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Michigan, Mississippi, Missouri, Nebraska, Nevada, North Carolina, Ohio, Oregon, South Carolina, West Virginia, Wisconsin—21 States; (*b*) appointed by the governor in Delaware, Florida, Georgia, Maine, Minnesota, New Hampshire, Pennsylvania, Tennessee—8 States; (*c*) elected by the legislature in New York, Vermont, Virginia—3 States; (*d*) appointed by State board in Connecticut, Maryland, Massachusetts, New Jersey, Rhode Island, Texas—6 States.

(2) *Term of service.*— (*a*) One year in Delaware and Rhode Island—2 States; (*b*) two years in Alabama, Arkansas, Colorado, Indiana, Iowa, Kansas, Michigan, Minnesota, Nebraska, New Hampshire, South Carolina, Tennessee, Vermont, Wisconsin—14 States; (*c*) three years in Maine, New Jersey, New York, Ohio—4 States; (*d*) four years in California, Florida, Georgia, Illinois, Kentucky, Louisiana, Mississippi, Missouri, Nevada, North Carolina, Oregon, Pennsylvania, Virginia, West Virginia—14 States; (*e*) indefinite in Connecticut, Maryland, Massachusetts, Texas—4 States.

(3) *Duties.*— (*a*) Makes official visits in Alabama, Arkansas, California, Colorado, Connecticut, Delaware, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Jersey, New York, Ohio, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, Wisconsin—29 States; (*b*) apportions school revenue in Arkansas, California, Colorado, Georgia, Indiana, Kansas, Louisiana, Michigan, Missouri, Nebraska, Nevada, New Jersey, New York, North Carolina, Rhode Island, South Carolina, Virginia, Wisconsin—18 States; (*c*) grants State licenses in Arkansas, Florida, Illinois, Nebraska, New Jersey, New York, Wisconsin—7 States; (*d*) prescribes or recommends text books in Arkansas, Kansas, Nebraska, Rhode Island, South Carolina, Wisconsin—6 States; (*e*) construes school law in Arkansas, Georgia, Illinois, Indiana, Iowa, Kansas, Michigan, Mississippi, Missouri, Nebraska, New Jersey, Ohio, Pennsylvania, South Carolina, Virginia, West Virginia—16 States; (*f*) hears appeals in Florida, Georgia, Indiana, Iowa, Kansas, New Jersey, New York, Rhode Island, Wisconsin—9 States; (*g*) appoints county superintendents in Alabama.

(4) *Number of superintendents and average length of term since creation of the office.*— Alabama 4, 2 years; Arkansas, —; California 7, 4.3 years; Colorado, —; Connecticut 7, 5.3 years; Delaware, —; Florida 4, 2 years; Georgia 2, 5 years; Illinois 6, 4 years; Indiana 12, 2.5 years; Iowa 11, 3 years; Kansas, —; Kentucky 12, 3.6 years; Louisiana 3, 3.3 years; Maine 9, 3 years; Maryland 2, 7.3 years; Massachusetts 5, 8.6 years; Michigan 6, 4.5 years; Minnesota, —; Mississippi 4, 2 years; Missouri 9, 4.1 years; Nebraska 3, 3 years; Nevada 2, 7 years; New Hampshire 17, 1.9 years; New Jersey 5, 7 years; New York, 5, 5.2 years; North Carolina 4, 7 years; Ohio 10, 3 years; Oregon, —; Pennsylvania 15, 2.3 years; Rhode Island 8, 4.2 years; South Carolina 1, 8 years; Tennessee 3, 3 years; Texas 2, 4 years; Vermont 6, 4.5 years; Virginia 1, 7 years; West Virginia 5, 3 years; Wisconsin 9, 2.7 years.

II. STATE BOARD OF EDUCATION.

(*a*) States having State boards: California, Colorado, Connecticut, Delaware, Florida, Georgia, Indiana, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Mississippi, Missouri, Nevada, New Jersey, North Carolina, Oregon, Rhode Island, South Carolina, Tennessee, Texas, Virginia—24 States; (*b*) composed chiefly of professional teachers in California, Connecticut, Indiana, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Nevada, Rhode Island, South Carolina, Tennessee—13 States; (*c*) composed chiefly of State officers in Colorado, Delaware, Florida, Georgia, Mississippi, Missouri, New Jersey, North Carolina, Oregon, Texas,

Virginia—11 States; (*d*) appoints the State superintendent in Connecticut, Maryland, Massachusetts, New Jersey, Rhode Island, Texas—6 States; (*e*) appoints county superintendents in Mississippi, New Jersey, Virginia; and county board in Florida and South Carolina—5 States; (*f*) prescribes or recommends text books in California, Connecticut, Delaware, Kentucky, Louisiana, Nevada, North Carolina, Oregon, South Carolina, Virginia—10 States; (*g*) prepares questions for use of local examiners of teachers in Indiana and Michigan—2 States; (*h*) issues State licenses in California, Colorado, Indiana, Kansas, Kentucky, Maryland, Michigan, Nevada, Oregon, Rhode Island, South Carolina—11 States.[1]

III. CHIEF COUNTY OFFICER.

(*a*) States having a county superintendent or examiner: Alabama, Arkansas, California, Colorado, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Maryland, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Jersey, New York, North Carolina, Oregon, Pennsylvania, South Carolina, Tennessee, Vermont, Virginia, West Virginia, Wisconsin—29 States; (*b*) term of service: One year in Delaware and Vermont—2 States; three years in New Jersey, New York, and Pennsylvania—3 States; four years in Georgia, Illinois, and Virginia—3 States; two years in the other States above mentioned—21 States; (*c*) appointed by State superintendent in Alabama—1 State; by governor in Delaware and Florida—2 States; by State board in Mississippi, New Jersey and Virginia—3 States; by township trustees in Indiana—1 State; by school directors in Pennsylvania—1 State; by town superintendents in Vermont—1 State; by county court in Arkansas, Kentucky, and Tennessee—3 States; by county board in Georgia, Maryland, and North Carolina—3 States; elected by the people in California, Colorado, Illinois, Iowa, Kansas, Minnesota, Missouri, Nebraska, Nevada, New York, Oregon, South Carolina, West Virginia, Wisconsin—14 States; (*d*) examines and licenses teachers in Arkansas, Colorado, Florida, Georgia, Illinois, Indiana, Iowa, Maryland, Minnesota, Mississippi, Missouri, Nebraska, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Tennessee, Vermont, Virginia, Wisconsin—21 States; and is member of examining board in Alabama, California, Kansas, Kentucky, Nevada, South Carolina, West Virginia—7 States; (*e*) member of county board of education in Florida, Georgia, Indiana, North Carolina, Virginia—5 States; (*f*) visits schools in Alabama, California, Colorado, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Maryland, Minnesota, Mississippi, Nebraska, Nevada, New Jersey, New York, Oregon, Pennsylvania, South Carolina, Tennessee, Virginia, Wisconsin—23 States; (*g*) disburses or apportions school revenue in Alabama, California, Colorado, Georgia, Illinois, Kansas, Nebraska, Nevada, New Jersey, New York, Oregon, South Carolina, Virginia, West Virginia—14 States.

IV. COUNTY BOARDS OF EDUCATION AND EXAMINATION.

(*a*) States having such boards: California, Florida, Georgia, Indiana, Kansas, Kentucky, Louisiana, Maryland, Mississippi, Nevada, New Jersey, North Carolina, Ohio, South Carolina, Texas, Virginia, West Virginia—17 States; (*b*) examines and licenses teachers in California, Kansas, Kentucky, Louisiana, Nevada, New Jersey, Ohio, South Carolina, Texas, West Virginia—10 States; (*c*) employs teachers in Florida, Georgia, Louisiana—3 States; (*d*) prescribes text books in Georgia, Indiana, Kentucky-Maryland—4 States; (*e*) levies local school taxes in Florida, Maryland, North Caro, lina, Virginia—4 States.

V. TOWNSHIP AND DISTRICT OFFICERS.

(1) *Township trustees.*—(*a*) Levy local taxes in Iowa, Indiana—2 States; (*b*) locate and build school-houses in Indiana, Iowa, Ohio—3 States.

[1] Several States have boards of examiners, which issue State licenses, but such boards do not exercise the powers usually exercised by State boards of education.

(2) *District trustees or directors.*—(*a*) Levy local taxes in Colorado, Delaware, Illinois, Kentucky, Michigan, Minnesota, Nebraska, Nevada, New York, Ohio, Pennsylvania, Rhode Island, West Virginia, Wisconsin—14 States; (*b*) locate and build school-houses in California, Colorado, Delaware, Florida, Illinois, Kansas, Kentucky, Maryland, Michigan, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Hampshire, New York, North Carolina, Pennsylvania, Tennessee, Vermont, Virginia, West Virginia, Wisconsin—23 States.

VI. EMPLOYMENT OF TEACHERS.

(*a*) By county authority in Florida, Georgia, and Louisiana—3 States; (*b*) by township authority in Alabama, Indiana, Maine, Massachusetts, New Hampshire—5 States; (*c*) by district authority in Arkansas, California, Colorado, Connecticut, Delaware, Illinois, Iowa, Kansas, Kentucky, Maryland, Michigan, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Jersey, New York, North Carolina, Ohio, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Vermont, Virginia, West Virginia, Wisconsin—30 States.

VII. EXAMINATION AND SUPERVISION OF TEACHERS.

(*a*) Examined by county authority in Alabama, Arkansas, California, Colorado, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Jersey, New York, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, Tennessee, Texas, Vermont, Virginia, West Virginia, Wisconsin—31 States; (*b*) examined by town or township authorities in Connecticut, Maine, Massachusetts, Michigan, New Hampshire, Rhode Island—6 States; (*c*) examined by the State superintendent in Delaware—1 State; (*d*) supervised by county authority in California, Colorado, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Maryland, Minnesota, Missouri, Nebraska, Nevada, New Jersey, New York, Oregon, Pennsylvania, South Carolina, Tennessee, Virginia, Wisconsin—22 States; (*e*) supervised by township authority in Alabama, Connecticut, Maine, Massachusetts, Michigan, New Hampshire, Rhode Island, Vermont—8 States; (*f*) supervised by district authority in Arkansas, Kentucky, Louisiana, Mississippi, North Carolina, Texas, West Virginia—7 States; (*g*) no supervision in Ohio; (*h*) States in which teachers are examined and supervised by the same person or persons: Alabama, California, Colorado, Connecticut,[1] Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas,[1] Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, Nevada,[1] New Hampshire, New Jersey, New York, Oregon, Pennsylvania, Rhode Island, South Carolina,[1] Tennessee, Virginia, Wisconsin—29 States.

VIII. FINANCIAL SYSTEM.

(1) *State revenue.*—(*a*) An ad valorem tax permanently fixed by statute levied in Arkansas, California, Connecticut, Georgia, Indiana, Kentucky, Louisiana, Maine, Maryland, Nebraska, Nevada, New Jersey, New York, North Carolina, Ohio, Oregon, Texas, South Carolina—18 States; (*b*) an ad valorem tax periodically fixed by statute levied in Florida, Illinois, Tennessee, Virginia, West Virginia—5 States; (*c*) legislative appropriations from treasury in Alabama, Delaware, Massachusetts, Pennsylvania, Rhode Island—5 States; (*d*) no State tax in Colorado, Iowa, Kansas, Michigan, Minnesota, Mississippi, Missouri, New Hampshire, Vermont, Wisconsin—10 States: (*e*) rank of the States in respect to the proportion which the State's school revenue bears to the amount expended for tuition: Arkansas, Kentucky, North Carolina, and South Carolina more than the whole; California, 98 per cent.; New Jersey, 91; Louisiana, 86; Alabama, 82; Indiana, 76; Maryland, 75; Oregon, 67; New York, 58; Virginia, 51; West Virginia, 47; Ohio, 46; Connecticut, 43; Maine, 42; Nebraska, 42; Massa-

[1] The person who supervises belongs to the board which examines teachers.

chusetts, 39; Rhode Island, 36; Florida, 35; Illinois, 27; Delaware, 25; Pennsylvania, 20.

(2) *Local taxes.*[1]—(*a*) Levied by counties in Alabama, Arkansas, California, Colorado, Florida, *Georgia*, Illinois, Iowa, *Kentucky*, Louisiana, Maryland, Mississippi, Nevada, North Carolina, Oregon, Tennessee—17 States; (*b*) by townships in *Connecticut*, Illinois, Indiana, *Iowa*, Maine, Massachusetts, Michigan, New Jersey, Vermont, Virginia—10 States; (*c*) by districts in *California*, *Colorado*, *Connecticut*, Delaware, Illinois, *Iowa*, *Kansas*, *Kentucky*, Michigan, *Minnesota*, Missouri, *Nebraska*, *Nevada*, *New Hampshire*, *New Jersey*, New York, Ohio, Oregon, Pennsylvania, Rhode Island, Texas, West Virginia, Wisconsin—23 States.

[1] In those States which are italicized the levy is made by a vote of the people.

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LETTER.

DEPARTMENT OF THE INTERIOR,
BUREAU OF EDUCATION,
April 14, 1880.

SIR: The recent prolonged hard times have impressed educators anew with the great perils to public welfare arising from the neglect of the rights and privileges of children. Never before have those among us who are interested in education come to so lively an appreciation of the extent to which vice, pauperism, and crime in all their forms—with all their perils to the individual, family, State, and nation, or to labor and capital—are traceable to the misuse of the rights and privileges of childhood. The necessity of universal education is enforced by new arguments. A considerable number of States have sought to secure it by compulsory education, so called, but the manner in which it has been attempted has not always been cordially received, and the end sought has not always been attained. Important societies have been organized to prevent cruelty to children. Truant laws have been enacted and truant police employed with good results. Measures to prevent the employment in different industries of children that have not attended school a specified period of a given year have been found useful, and charitable visitation has increased the benefits of instruction among poor children by inquiries as to their school attendance and by providing food and clothing. More and more has agitation turned attention to the laws of the different States: this Office has been very much taxed in giving information of this character; teachers, parents, school officers, philanthropists, statesmen, have sought to find out what the laws now provide, to compare those of one State with another, and to ascertain what modifications are desirable. I have therefore had prepared, from the collection of school laws in this Office and from the unequalled collection of statutes and decisions of States in the law department of the Congressional Library, a summary of the legal rights of children. The difficult task has been executed by S. M. Wilcox, esq., a careful student of law, who has had the advantages of personal observation of these laws in New England, Pennsylvania, and this District. It will be observed how deeply embedded in the legal foundation of the several States is the child's right to education, and how the universal recognition of this right as obligatory would increase the efficiency of instruc-

was, for the benefit of the child, reputed in the same condition as if born, and the common law is in this respect the same. Both in England and in this country, it is well settled that an infant in ventre sa mere is deemed to be in esse, or in being, for the purpose of taking a remainder, or any other estate or interest which is for his benefit, whether by descent, devise, or under the statute of distribution. Under the law of England a bill may be filed in its favor, a court of equity will grant an injunction to protect its rights, and the destruction of such a child is murder; and in most of our own States the destruction of such a child by any means is made a felony, unless where such act is necessary to preserve the life of the mother.

The common law doctrine as to such infants seems to have been recognized to its fullest extent in this country, although it is generally regulated by statute, but such statutes will, in most cases, be found to be reënactments of the common law, and where they vary from that it is in extending the common law rights of such infants.

The child, then, is to be considered in being from the time of conception, when it is for the benefit of the child that it should be so considered. As respects the rights of third persons, or those claiming through the infant, if the child should be born dead or in such an early stage of pregnancy as to be incapable of living, it is to be considered as never having been conceived or born. Children born within six months after conception are presumed to be incapable of living, and therefore cannot take and transmit property by descent unless they actually survive long enough to rebut that legal presumption.

When the mother dies before the birth of the child, and the latter is delivered by the cæsarean operation, it is considered in existence before its birth, for its own benefit to take the estate of the mother by descent, but not for the benefit of the father to enable him to hold as tenant by the curtesy. Tyler on Inf. §§ 151 to 158.

WHO ARE INFANTS.

By the common law no person acquires fully all his political and civil rights until he is 21 years of age, at which time his infancy terminates. This rule, however, does not prevail in all systems of jurisprudence, for in Spain and some other countries emancipation does not take place until the age of 25.

By the common law the period of emancipation is the same for both sexes. In the American States the common law rule prevails, except where it has been changed by statute. In Vermont, Ohio, Illinois, and Nebraska females are considered of full age at 18. In Maryland females of that age may dispose of their real estate by will, and in Texas a female under 21 who shall marry in accordance with the laws of the State is deemed of full age after such marriage. R. S. Vt. 1863, chap. 72, § 1; *Sparhawk* vs. *Buell's Adm.* 9 Vt. Rep. 41; *Stevenson* vs. *Westfall*, 18 Ill.

209; 1 R. S. Ohio, ch. 56, § 1; Md. Code, art. 93, § 300; R. S. Neb. ch. 22, § 1; Oldham & White's Digest, Texas, art. 1400.

DISPOSAL OF CHATTELS BY WILL.

While, as a general rule, an infant labors under certain disabilities, it is not our purpose to give a detailed account of these disabilities, but rather to give some idea of the privileges granted and guards thrown around him by the law. The adult may do many things in reference to which the infant is either forbidden to act, or, if not forbidden, can only act under certain well defined legal restrictions, but the tendency of the law in many respects has been to make the privilege the rule and the disability the exception.

While, as we have seen, an infant may take and hold property, real and personal, yet, by the common law, he cannot make a will of lands. But by the common law an infant may make a testament of chattels; if a male, at the age of 14, and if a female, at the age of 12 years. The civil law gave the infant the power to dispose of chattels by will at the age of 17.

In this country the matter has been very generally regulated by statute. The rule of the civil law has been adopted in Connecticut and Illinois. In Vermont, Massachusetts, New Hampshire, Ohio, Pennsylvania, Maine, Indiana, New Jersey, North Carolina, Mississippi, Nebraska, Texas, and Florida none under full age can devise either real or personal property. In Maryland, Rhode Island, Missouri, Oregon, and Virginia, wills of personal estate may be made after 18. In New York the period is 18 for males and 16 for females. In South Carolina an infant of 18 years may make a valid will of personalty by conforming to certain statute provisions.

VOID AND VOIDABLE ACTS.

In *Cecil* vs. *Salsbury*, 2 Vern. Ch. R. 224, Lord Mansfield is reported to have said:

> Miserable, indeed, must the condition of minors be; excluded from the society and commerce of the world; deprived of necessaries, education, employment, and many advantages; if they could do *no* binding acts. Great inconvenience must arise to *others* if they were *bound* by no act. The law, therefore, at the same time that it protects their imbecility from injury through their own imprudence, enables them to do binding acts for their own benefit and, without prejudice to themselves, for the benefit of others.

In an early case in Massachusetts Justice Wilde says:

> In all cases the benefit of the infant is the great point to be regarded; the object of the law being to protect his imbecility and indiscretion from injury, through his own imprudence, or by the craft of others. *Oliver* vs. *Houdlet*, 13 Mass. 237.

This protection is afforded by considering his acts as not binding in certain cases and allowing him to rescind his contracts with certain exceptions. There are two degrees in which his acts are not binding:

first, where they are held to be wholly void, and, second, where they are defeasible, at the election of the infant.

A void act never is or can be binding upon any one, and it is incapable of being confirmed. There is some uncertainty in the books as to the line of distinction between the void and voidable acts of an infant, with an apparent inclination in the courts to narrow the first and enlarge the latter. *Tucker* vs. *Moreland*, 10 Peters, 58.

The reason of this seems to be that, as the principle is the protection of the infant against his own weakness, if this protection can be secured to him without inflicting a detriment on innocent persons, such infliction must be unnecessary and unjust. To consider any acts of an infant absolutely void might operate to his own protection, but it would in many cases seriously affect the rights of third persons in no wise implicated in the infant's transactions, and might not unfrequently be prejudicial to the infant himself.

This is strongly enforced by Bingham, and his reasoning is in the main approved by Tyler. Bingham on Infancy, p. 14; Tyler on Infancy, § 10.

Any attempted enumeration of the acts which have been held void or voidable, or a discussion of the mode in which the infant may avoid or ratify and confirm his voidable acts, is not within the purview of the present inquiry. The precedents and decisions in these cases are numerous, easily accessible, and of sufficient variety to satisfy any reasonable inquirer.

The privilege conferred by law upon infancy is a personal one, and, as a general rule, no one but the infant himself or his legal representatives can avoid his voidable acts, deeds, and contracts, for while living he ought to be the exclusive judge of the propriety of the exercise of a personal privilege intended for his benefit, and when dead they alone should interfere who legally represent him. Tyler, § 19; *Hyer* vs. *Hyatt*, 3 Cranch C. C. 276.

The indulgence allowed by the law to infants, being for their own security, cannot be taken advantage of by persons of full age and legal capacity to contract. Hence, although the infant may avoid his contract, yet it is binding on a person of full age who contracts with him. "Every person deals with an infant at arm's-length, at his own risk, and with a party for whom the law has a jealous watchfulness." Story on Contracts, § 13.

All parties dealing with an infant, whether as co-contractors with him or as adverse parties, are liable upon such contracts, co-contractors in any event and adverse parties until the contract is disaffirmed by the infant.

As to the time when the voidable acts may be disaffirmed, the rule laid down is that all executory contracts and all contracts respecting personal property may be avoided by the infant either before or upon his

coming of age, but conveyances of realty cannot be avoided until he attains full age. Tyler, § 30.

But an infant cannot retain the benefits of his contract and thus affirm it, and yet plead infancy to avoid the payment of the purchase money. *Henry* vs. *Root*, 33 N. Y. Rep. 526.

If the contract has been fully executed on both sides, and the infant disaffirm and reclaim what he has paid, he must restore the consideration received. *Bigelow* vs. *Kinney*, 3 Vt. 353; *Williams* vs. *Norris*, 2 Littell's R. 157; *Hill* vs. *Anderson*, Sme. & Mar. 216; *Grace* vs. *Hale*, 2 Humph. 27; *Smith* vs. *Evans*, 5 ib. 70; *Badger* vs. *Phinney*, 15 Mass. 359; *Edgerton* vs. *Wolf*, 6 Gray's [Mass.] Reps. 453.

WHEN INFANTS MAY BE WITNESSES.

An infant may be a witness if proved to have sufficient discretion and understanding of the obligation of an oath. The test universally is that the child feel the binding obligation of an oath from the general course of his religious education. The effect of an oath upon the conscience of a child should arise from religious feelings of a permanent nature, and not merely from instructions confined to the nature of an oath, recently communicated for the purpose of the trial. *Rex* vs. *Williams*, 32 E. C. L. 524. But in one case where a child 9 years old, though very intelligent, did not understand the nature of an oath nor the moral penalty of false swearing, the court instructed her on the spot and then allowed her to be sworn. *Jenner's case*, 2 City Hall R. (N. Y.) 147. And children of 10, 9, 7, and even 5 years of age have been held competent. *Regina* vs. *Perkins*, 38 E. C. L. 236; *Commonwealth* vs. *Hutchins*, 10 Mass. 225; *State* vs. *Whittier*, 21 Maine, 341.

But the question rests mainly in the discretion of the court. The adverse party may require that a witness of tender years shall be examined as to his understanding of the nature and obligation of an oath, and, before the child is admitted to testify, the judge must be satisfied that the child feels the binding obligation of an oath. *People* vs. *McNair*, 21 Wend. 608.

MARRIAGE.

The common law age of consent to marriage is 14 for males and 12 for females. Contracts of marriage, where both parties are of the age of consent, if executed, are as binding as if made by adults; but if either party is under that age, *both* have the privilege of avoiding, a principle not found in any other contracts of infants.

The common law rule is in force in New York and Texas and in most of the other States. In Maine, Vermont, Mississippi, and Missouri males under 21 and females under 18 are forbidden to marry without the consent of the parents. In Ohio the age is 18 for males and 14 for females. In Indiana and Illinois the age is 17 for males and 14 for

females. In Wisconsin, Minnesota, and Oregon, males 18 and females 15. In Michigan and Nebraska, males 18, females 16. In Iowa and North Carolina, 16 and 14. Maryland imposes a fine for performing the marriage ceremony, where the parties are under 21 for males and 16 for females, without the consent of the parents.[1]

In most of the States the law requires publication of banns or a license, and as a general rule the consent of the parents is required where the parties, or either of them, are under full age.

In the absence of any specific provision declaring marriages not celebrated in the prescribed mode as between parties under certain ages absolutely void, it is held that all marriages regularly made according to the common law are valid and binding, although had in violation of specific statute regulations. 2 Kent's Com. 90, 91; 2 Greenl. Ev. § 460; *Londonderry* vs. *Chester*, 2 N. H. 268; *Hantz* vs. *Sealy*, 6 Binney (Pa.), 405; *Milford* vs. *Worcester*, 7 Mass. 48; *Parton* vs. *Hervey*, 1 Gray, 119.

The punitive provisions of the statutes are treated as directory only upon ministers and magistrates, and to prevent, as far as possible, by penalties on them, the solemnization of marriages when the prescribed conditions and formalities have not been complied with. See on this subject Tyler, §§ 81 to 84, 91, 92.

THE STATUTE OF LIMITATIONS.

It is a maxim of the law that no laches or neglect is imputable to an infant during his minority, because he is not supposed to be cognizant

[1] The Lyon Médical gives the following as the legal marriageable ages for men and women in different countries of Europe:

Country.	For men.	For women.
	Years.	*Years.*
Austria	14	14
Belgium	18	15
France	18	15
Germany	18	14
Greece	14	12
Hungary (Orthodox and Catholic)	14	12
Hungary (Protestant)	18	15
Italy	18	15
Portugal	14	12
Roumania	18	16
Russia	18	16
Saxony	18	16
Spain	14	12
Switzerland	14 to 20	12 to 17

of his rights or capable of enforcing them. *Ware* vs. *Brush*, 1 McLean, 533. When, however, the matter is regulated by statute, and there is no exception or saving in favor of any incapacity, laches will bar an infant the same as an adult. *Rayner* vs. *Watford*, 2 Dev. (N. C.) Law R. 338.

By the common law the statute of limitations does not run against an infant, but this is now regulated by statute, and the statute will run against infants unless they are specially exempted. Angell on Lim. § 194.

By the English law the statute does not run against infants in personal actions; that is, the computation does not commence until the infancy terminates.

The same is true in Vermont, Massachusetts, Rhode Island, New Jersey, Pennsylvania, Maryland, District of Columbia, Virginia, North Carolina, South Carolina, Georgia, Florida, Mississippi, Louisiana, Kentucky, Missouri, Arkansas, Texas, Ohio, Indiana, Illinois, Michigan, California, Iowa, Nebraska, and Kansas.

In England real actions may be brought in ten years after the minority ceases, and the time is the same in Maine, Rhode Island, New York, Pennsylvania, Delaware, Virginia, South Carolina, Florida, Kentucky, Ohio, and Michigan.

The term is five years in New Hampshire, Massachusetts, Connecticut, New Jersey, Arkansas, Wisconsin, and California.

The term is three years in North Carolina, Alabama, Tennessee, and Missouri; and in Minnesota and Oregon one year.

In Maine personal actions must be brought in six months after arriving at full age; in New Hampshire, New York, Minnesota, and Oregon, in one year; in Delaware, Alabama, and Tennessee, in three years, and in Connecticut, in four years on bonds and specialties and in three years in other personal actions.

In the other States the statute does not begin to run until full age. Tyler, chap. 10.

The statute does not bar a trust estate, but the doctrine holds good only as between the trustee and cestui que trust, and not between them on the one side and third persons on the other. *Huntingdon* vs. *Huntingdon*, 3 P. Williams, 310; *Lyon* vs. *Marclay*, 1 Watts, 275; *White* vs. *White*, 1 Md. Ch. 53; *Thomas* vs. *Brinsfield*, 7 Geo. R. 154.

When the statute makes no exception in favor of infants, the court of chancery will make none. *Demarest* vs. *Wyncoop*, 3 Johns. Ch. 146.

LIABILITY OF INFANTS TO SUIT.

I.— Civil suits.

Whenever an infant may be intrusted with an office, it follows as a matter of course that he is liable to the consequences of his acts in the exercise of such office. Tyler, § 121.

Wherever the infant is allowed to make a binding contract or perform

a valid act, he is liable to an action for non-performance or default, the same as an adult. *Railway* vs. *Coombe*, 3 Excheq. R. 569; *Railway* vs. *McMichael*, 5 ib. 126; *U. S.* vs. *Bainbridge*, 1 Mason, 71.

In all suits brought against infants, whom the law supposes to be incapable of understanding and managing their own affairs, the duty of watching over their interests devolves in a considerable degree upon the court. They defend by guardian appointed by the court, who is usually the nearest relative not concerned in point of interest in the matter in question. U. S. Supreme Ct. *Bank* vs. *Ritchie*, 8 Peters, 128.

Infants are liable for torts and injuries of a private nature and for all wrongs committed by them the same as adults. If the tort is committed with force, the infant is liable at any age. In such cases the intention is not regarded, and a lunatic is as liable to compensate in damages as a man in his right mind. Reeves' Dom. Rel. 256; *Baxter* vs. *Brush*, 29 Vt. 465; *Scott* vs. *Watson*, 46 Maine, 362; *Cutts* vs. *Phalen*, 2 Howard (U. S.), 376; *Vasse* vs. *Smith*, 6 Cranch, 226.

The general rule, however, is that the act must be wholly tortious in order to charge the infant. *Jennings* vs. *Rundell*, 8 Tenn. R. 337; *West* vs. *Moore*, 14 Vt. 447; *Merrill* vs. *Aden*, 19 Vt. 505; *People* vs. *Kendall*, 25 Wend. 399.

When the injury happened through unskilfulness, want of knowledge, discretion, or judgment, infancy will be a bar. *Campbell* vs. *Stokes*, 2 Wend. 137.

In New York it has been held that exploding fire crackers by an infant in the public streets of a city is unlawful, and if any damage to persons or property results therefrom the wrongdoer is liable to compensate the sufferer, and his infancy is no protection. *Conklin* vs. *Thompson*, 29 Barbour, 218.

In Massachusetts it has been held that an infant who hires a horse to go to a place agreed upon, but goes to another, is liable in tort for an unlawful conversion the same as an adult, but in Pennsylvania the reverse is held. *Homer* vs. *Thwing*, 3 Pick. 492; *Penrose* vs. *Curren*, 3 Rawle, 351; *Wilt* vs. *Walsh*, 6 Watts, 9; see also *Fish* vs. *Ferris*, 5 Duer, 49.

An infant who obtains property upon a representation that he is of full age is liable in an action of tort for damages or the recovery of the property. *Eckstein* vs. *Franks*, 1 Daily, 334; *Badger* vs. *Phinney*, 13 Mass. 345; *Cutts* vs. *Phalen*, 2 How. 376.

In cases of fraud, infancy is no defence in equity. Tyler, § 126.

An infant has been held liable in trespass for having procured another to commit an assault (*Sikes* vs. *Johnson*, 16 Mass. 389), but Chitty says an infant cannot be a trespasser by prior or subsequent consent, but only by his own act (1 Chitty's Pl. 7th Am. ed. 86), and an infant is not responsible for the negligence of one acting as his servant. *Robbins* vs. *Mount*, 33 How. Pr. Rep. 24.

II.—As to crimes.

Infants who have attained the years of discretion are regarded in law as capable of committing crimes the same as adults, and may be prosecuted and punished accordingly.

By the ancient Saxon law 12 years was established for the age of possible discretion. Between 12 and 14 one might or might not be guilty of a crime, according to his capacity or incapacity. Under 12 he could not be guilty in will; after 14 he could not be supposed innocent of any capital crime he had in fact committed.

In the absence of statutory provisions the court will look not so much to the age of the delinquent as to his strength of understanding and judgment. For, as has been said, "one lad at 10 years of age may have as much cunning as another of 14; and in these cases the maxim is Malitia supplet ætatem, "malice supplies the want of age." Tyler, § 129.

As a general rule, however, infants of less than 7 years cannot be punished as criminals. Before that age they are not in law considered as possessed of sufficient reason to be accountable or answerable for their acts, and it is only from 14 that the law holds them entirely responsible.

Under 7 the presumption of right is that one cannot have discretion, and no averment must be received against that presumption. Over 7 and under 14 he is prima facie not guilty; yet, if it appear by strong circumstances and pregnant evidence that he had discretion to judge between good and evil, judgment even of death may be given against him. *Rex* vs. *Owen*, 19 E. C. L. 493; *Commonwealth* vs. *McKeagy*, 1 Ashmead, 248; *State* vs. *Aaron*, 1 Southard, 231; *State* vs. *Doherty*, 2 Overton, 80; *Reniger* vs. *Fogossa*, Plowden, 19, note; see also Tyler, §§ 121–131.

This may be taken as the established rule where it has not been modified by statute, as it has been in some of the States. In Alabama, infants under 12 cannot be guilty of a crime or misdemeanor, and in California the age is fixed at 14.

All the books agree that where an act is denounced as a crime, even of felony or treason, by a general statute, it extends as well to infants if above 14 years, as to others. *People* vs. *Kendall*, 25 Wend. 399.

LIABILITY FOR NECESSARIES.

A husband is by law bound to support his wife, and if he refuse or neglect to provide her with necessaries suitable to his means and condition or so conduct himself towards her as to justify her in leaving him, or if, without reasonable cause, he drive her from his house, he thereby invests her with the right to pledge his credit for such necessaries.

By the common law parents are bound to maintain their children during their minority, and the same obligation is recognized in the civil

law. They are entitled to the earnings of the infant, but it will be found that the rule of liability for necessaries in the case of parent and child is different from that enforced as between husband and wife.

There are cases in which it was held that the duty of a parent to maintain his offspring was a perfect common law duty; and that a stranger might furnish necessaries for the child and recover of the parent compensation therefor, when there was a clear and palpable omission of duty on the part of the parent in supplying his minor child with necessaries. *In re Rider*, 11 Paige, 188; *Van Valkenburgh* vs. *Watson*, 13 Johns. 480; *Edwards* vs. *Davies*, 16 Johns. 285; *Urmston* vs. *Newcombe*, 31 E. C. L. 393. But it may be noted that in several of these cases the parent was not charged.

Whether the fact that a father turns away his child from home, or neglects to provide for him, or so cruelly treats him that he cannot remain under the paternal roof, is sufficient to make the father responsible to any one supplying the child under such circumstances seems to be in doubt.

In a leading case in Connecticut the court says:

> Parents are bound by law to maintain, protect, and educate their legitimate children during their infancy. This duty rests in the father, but because the father has abandoned his duty and trust, by putting his child out of his protection, he cannot thereby exonerate himself from its maintenance, education, and support. The duty remains, and the law will enforce its performance, or there must be a failure of justice. The father having forced his child abroad to seek sustenance under such circumstances, sends a credit along with him, and shall not be permitted to say it was furnished without his consent or against his will. *Stanton* vs. *Wilson*, 3 Day, 37.

But in a subsequent case this decision was commented upon and the doctrine denied. *Finch* vs. *Finch*, 22 Conn. 411. And in New York the doctrine would seem to have been avowed, as against the earlier cases, that there is no legal obligation on a parent to maintain his child independent of the statutes. *Raymond* vs. *Loyle*, 10 Barbour, 483.

In *Gordon* vs. *Potter*, 17 Vt. 350, Redfield, J., says:

> I know there are some cases and dicta of judges, or of elementary writers, which seem to justify the conclusion that the parent may be made liable for necessaries for his child, even against his own will. But an examination of all the cases upon this subject will not justify any such conclusion.

In England the parent may by statute be compelled to support a minor child, and it is there held that the only remedy in case the child is abandoned to destitution is that pointed out by the statute. *Mortimer* vs. *Wright*, 6 Meeson & Welsby, 482. And the law is declared to be well settled that without some contract, express or implied, the father is not liable for necessaries. *Shelton* vs. *Springett*, 20 E. L. and Eq. 281; *Baker* vs. *Keene*, 3 E. C. L. 449.

In this country the laws of the several States impose the duty of support of minor children upon the parents, and they also make it the duty of the children to support their parents when they are of ability and the parent is in need. They provide the mode for enforcing the liability in

either case, and the tendency of the decisions is in the same direction as the English. It may therefore be now taken as the rule that, in order to charge the father on his son's contract for necessaries, the same circumstances must be shown as would be sufficient to charge an uncle, brother, or any third person; that is, there must be an express or implied agency. Tyler, § 64.

But in order that an infant may not be forced into a position where, whatever his need, he might not be able to obtain food, shelter, or raiment, the law has adopted a rule, which is regarded and treated as an exception to the general rule, that an infant may make a valid contract for necessaries, and such contract is neither void nor voidable.

It is said that the obligations of infants to pay for necessaries arise, not so much by virtue of a contract so to do as on the ground of an implied legal liability, based upon the necessity of their situation, precisely in the same manner as with idiots and lunatics, who are absolutely incompetent to contract; yet in both cases, it being necessary for the parties to live, the law allows a reasonable compensation to any one supplying them. The infant's necessity, therefore, being the ground of his liability, it follows that when no such necessity exists all responsibility fails.

There are numerous cases in the books as to when and under what circumstances an infant may be bound for necessaries and what are to be considered necessaries, and the duty devolving upon the party furnishing, a review of which would require too much space for our present purpose. Upon these questions the inquirer is referred to the works of Bingham, Ewell, and Tyler.

RIGHTS OF CHILDREN AS TO PARENTS, MASTERS, OR GUARDIANS.

In treating of the subjects of guardianship, apprenticeship, adoption, and custody of children we are necessarily brought to consider more fully the respective rights, obligations, and powers of parent and child.

From the earliest times their respective rights and duties have been inculcated and enforced by law, and in modern times the state has assumed the power to control and regulate these relations. In a late case in New York Judge Westerbrook says: "The right of the state to care for its children has always, and with very great propriety, been exercised." In reference to the morals and education of children, the exercise of this power is worthy of especial notice, and this will be found to be a characteristic mark of the early colonial laws.

Perhaps the earliest of this character are to be found in the laws of the Massachusetts colony, afterwards adopted in Connecticut.

These early laws very clearly inculcate upon parents the duty of properly training and educating their children, and at the same time as clearly provide against any neglect of this duty. Inefficiency, negligence, and overindulgence on the part of parents were no more tolerated than a stubborn and rebellious spirit in the child. The inefficiency or want of control of the parents over the child would seem, in some

instances, to have been visited heavily upon the child. But if in this respect they adopted the severity of the Levitical code, they added conditions in favor of the child not to be found in the original law. The general provisions, however, were such, and were so administered, as to have a marked effect upon their posterity, and established principles which may be traced through much of the modern legislation upon these and kindred subjects, and for this reason a brief sketch of these laws may not be inappropriate.

A law of 1642 denounces the penalty of death upon any child over 16 years of age who shall smite or curse his natural father or mother, "unless it can be sufficiently testified that the parents have been very unchristianly negligent in the education of such children, or so provoked them by extreme or cruel correction that they have been forced thereunto to preserve themselves from death or maiming." And the same penalty is imposed upon a stubborn and rebellious son of over 16, who persists in such conduct and refuses to obey the voice and chastisement of his parents, but lives in sundry and notorious crimes. Ancient Charters and Laws, p. 59, ch. 18, §§ 13, 14.

Their care for children is, however, better shown in a series of laws of the same year and later, chiefly relating to education and good morals, and asserting the right to limit and control parental authority.

In 1642 it was provided—

Forasmuch as the good education of children is of singular behoof and benefit to any commonwealth, and whereas many parents and masters are too indulgent and negligent of their duty in that kind: it is ordered that the selectmen of every town, in the several precincts and quarters where they dwell, shall have a vigilant eye over their brethren and neighbors to see, first, that none of them shall suffer so much barbarism in any of their families as not to endeavor to teach, by themselves or others, their children and apprentices so much learning as may enable them perfectly to read the English tongue, and knowledge of the capital laws, under penalty of twenty shillings for each neglect therein; also, that all masters of families do at least once a week catechise their children and servants on the grounds and principles of religion; and, if unable to do so much, that then at the least they procure such children and apprentices to learn some short orthodox catechism without book, that they may be able to answer unto the questions that shall be propounded to them out of such catechism by their parents or masters, or any of the selectmen when they shall call them to a trial of what they have learned of that kind; and farther, that all parents and masters do breed and bring up their children and apprentices in some honest lawful calling, labor, or employment, either in husbandry or some other trade profitable for themselves and the commonwealth, if they will not or cannot train them up in learning to fit them for higher employments.

And if any of the selectmen, after admonition by them given to such masters of families, shall find them still negligent of their duty in the particulars aforementioned, whereby children and servants become rude, stubborn, and unruly, the said selectmen, with the help of two magistrates, or the next county court for that shire, shall take such children or apprentices from them, and place them with some masters for years (boys till they come to 21 and girls 18 years of age complete) which will more strictly look unto and force them to submit unto government, according to the rules of this order, if by fair means and former instructions they will not be drawn unto it.

In the year before, it had been provided that—

If any person shall wilfully and unreasonably deny any child timely or convenient marriage, or shall exercise any unnatural cruelty towards them, such children shall have liberty to complain to authority for redress in such cases.

No orphan during their minority, which was not committed to tuition or service by their parents in their lifetime, shall afterwards be absolutely disposed of by any, without the consent of some court, wherein two assistants (at least) shall be present, except in case of marriage, in which the approbation of the major part of the selectmen of that town, or any one of the next assistants, shall be sufficient; and the minority of women in case of marriage shall be 16 years.

It was also provided that where children and servants behaved themselves disorderly and disobediently towards their parents or masters any one magistrate might by warrant summon such offender before him and, upon conviction, sentence him to such corporal punishment as the case might deserve, not exceeding ten stripes for one offence, or bind him over for appearance at court.

For the protection of young persons from evil disposed companions, who might draw them away from their callings, studies, and honest occupations, to the dishonor of God and the grief of their parents, &c., it was provided that whoever should in any way cause or suffer any young people or persons whatsoever, whether children, servants, apprentices, or scholars belonging to the college or any Latin school, to spend any of their time or estate, by night or by day, in his or their company, ship, shop, &c., and should not from time to time discharge and hasten all such youths to their several employments and places of abode or lodging, should forfeit 40 shillings.

Laws, 1651.—It was also provided that if any persons should give credit to any youths or other persons under 21 years of age without an order in writing from their parents, guardians, or friends, they should lose their debt, whatever it might be. And further, if any such youth or person incurred any penalty by such means, and had not the wherewithal to pay, such person or persons as were the occasion thereof should pay it as the delinquents in like manner should do.

Laws, 1647.—A similar provision as to credits given to students of the military school or of any incorporated college has been adopted in the State of Virginia (Code of 1849, chap. 143, § 1; West Virginia School Code, § 94), and also in New Jersey (Nixon's Dig. 4th edit. 388–9).

It is to be noted that these laws furnish the earliest example of that special legislation which is now known as the compulsory education laws, which will be hereafter referred to, to be found in American legislation.

APPRENTICESHIP.

As a general rule the contract for apprenticeship must be in writing. The infant cannot be bound in pais, nor unless he is a party to the writing or deed. The term of service for males is until 21, and for females until 18. This is the common law rule.

The subject, however, is now, both in England and this country, regulated by statute. The laws of the several States will be found very nearly uniform in their essential provisions, the differences being mainly in unimportant details.

The early New England law may be found in the general laws of New Hampshire, 1878, chap. 187, and nearly the same provisions in New York, 3 R. S. 173.

The provisions are in substance as follows:

Children under 14 may be bound as apprentices without their consent, until they arrive at that age, by the father; or, if the father is not living, by the mother or guardian; or, if they have no parents or guardian, they may bind themselves, with approval of selectmen or overseers of the poor.

Minors over 14 may be similarly bound with their consent; females, until 18, or to the time of their marriage within that age; and males, until 21.

The indentures must be in writing, in duplicate, signed, sealed, and delivered by both parties; and, whenever a consent or approval is required, such consent or approval must be in writing and indorsed upon both parts of the indenture. All indentures executed as provided by law are good and effectual against all parties thereto.

Such indentures cease to be binding upon the minor, his parents, or guardian, upon the death of the master, but in some States provision is made for assignment of the same.

Parents, guardians, and the selectmen or overseers of the poor are required to inquire into the treatment of persons so bound, and defend them from cruel treatment, and make complaint thereof to any magistrate, who may discharge such indenture.

If any apprentice is guilty of gross misbehavior, wilful neglect, or refusal of duty, or shall use personal violence towards his master, the master may make complaint thereof and the magistrate may give judgment for damages and costs, and discharge indentures.

Any apprentice leaving service without cause may be arrested and returned, and the master may recover his reasonable expenses and damages therefor. Enticing or carrying away an apprentice is forbidden.

Any master neglecting to teach or cause to be taught to any apprentice the art, trade, or profession he was bound to teach, or to fulfil any part of his contract, is liable to such apprentice after he comes of age for all damages therefor.

In most of the States the selectmen of the town, overseers of the poor, or other officers possessing similar powers may bind out poor and destitute children having no means of support.

The difficulty of the present day, however, is not in the want of wholesome statutory provisions regulating the relations of master and apprentice, but in the absence of the means and opportunity to apply them to practical use. Leaving out of the account all those children

having independent property or parents who feel themselves responsible for their well being and aid them to the extent of their ability, what is to be done with that large class cast upon the world as waifs, either without parents or with parents or custodians whose highest ambition seems to be to sink them to the lowest level of vice and vagabondage? This is the problem which is becoming of great importance, especially in our large cities, the satisfactory solution of which is by no means free from difficulty.

GUARDIANSHIP.

Another mode in which the law provides for the protection of infants is by the provisions for the appointment of guardians.

The books classify guardianship as of two kinds, one by the common law and the other by statute. In this country, however, there is practically but one, inasmuch as the whole subject is regulated by statute provisions.

The father and, next to him, the mother are treated as the natural guardians, and have the preference in the appointment, but the courts having control of this relation may disregard this preference.

Judge Story says:

> Although in general parents are intrusted with the custody of the persons and the education of their children, yet this is done upon the natural presumption that the children will be properly cared for, and will be brought up with a due education in literature, morals, and religion, and that they will be treated with kindness and affection. But whenever this presumption is removed; whenever, for example, it is found that a father is guilty of gross ill treatment or cruelty towards his infant children, or that he is in constant habits of drunkenness and blasphemy, or low and gross debauchery, or that he possesses atheistical or irreligious principles, or that his domestic associations are such as to tend to the corruption and contamination of his children, or that he otherwise acts in a manner injurious to the morals or interests of his children, in every such case the court of chancery will interfere and deprive him of the custody of his children, and appoint a suitable person to act as guardian and to take care of them and superintend their education. (2 Story's Eq. § 1341.).

Guardians by statute are of four kinds: Testamentary guardians, who are appointed by the last will and testament of the father, and in some cases of the mother; guardians ad litem, who are appointed by the court to represent or defend an infant sued therein; special guardians, who are appointed by the court for a special purpose, to represent the infant in some special proceeding, or to perform some act which the infant might perform or would be required to perform if he were of full age, and whose duties are at an end when the transaction is accomplished; and, lastly, general guardians.

General guardians are appointed by certain courts upon which the jurisdiction is conferred by statute. In all the States, however, the court having chancery powers has a general jurisdiction over every guardian of an infant, and he is subject to the control and superintendence of such court. (2 Kent's Com. 227.)

As a general rule, an infant over 14 may by statute select his guardian, but such selection is subject to the approval of the court. It is the

duty of the court to consult the best interests of the child, taking into consideration not only his temporary welfare but also his training, education, and morals.

It will be found that the statute provisions on this subject are framed with a jealous regard to the rights and property of the infant and the courts are equally scrupulous and guarded, and the person taking upon himself this relation will be held to a strict accountability by all legal tribunals. The decisions and established rules are numerous and easy of access, and reference must be had to them to show the mode and extent to which courts will go for the protection of infants against any breach of trust on the part of their guardians. Practically, general guardians are not appointed unless there is property to which the infant is, or may be, entitled. The others, and by no means a small proportion, are left to the charity of the various public or private orphan associations, and their welfare in a great measure depends upon the solution of the problem before referred to.

ADOPTION OF CHILDREN.

In very many of the States provision has been made by law for the adoption of children by third persons. This is usually done under the direction of some court, usually, too, upon petition of the person desiring to adopt, and when the petitioner is married both husband and wife must join.

The parents of the child, if living, or, if dead, the guardian, must consent in writing. In case of an illegitimate child, the consent of the mother is sufficient. If there are no parents or guardian, the next of kin, or, in the absence of next of kin, the court may appoint some person who may give or withhold such consent.

The court must be satisfied of the identity of the persons whose consent is required and of the ability of the petitioner to bring up the child and furnish suitable nurture and education, having reference to the degree and condition of his parents, and the decree must set forth the facts.

From the date of the decree the child is, to all legal intents and purposes, the child of the petitioner.

In some of the States the child so adopted becomes, for the purpose of inheritance and for all other legal consequences and incidents, the child of the parents by adoption, as if born to them in lawful wedlock, except that he cannot take property expressly limited to the heirs of the body or bodies of the parents by adoption, and the natural parents are deprived of all rights as respects the child.

The court may change the name of such adopted child to that of the parents by adoption, and either party may appeal from such decree.

The mode of proceeding in such cases must, of course, conform to the statute provisions in each State, which must be consulted in such cases.

LABOR OF CHILDREN.

There are certain provisions of statute law in some of the States having for their object the protection of children from excessive toil unsuitable to their tender years.

In England the hours of labor for apprentices and servants are limited to ten hours a day and fifty hours a week.

Maine prohibits the employment of any person under 16 over ten hours each day. And no child is to be employed or suffered to work in any cotton or woollen factory without having attended school, public or private, under competent teachers, if under 12, four months, and, if over 12 and under 15, three months out of the twelve next preceding such employment. R. S. 1871, 425–6.

In New Hampshire no child under 15 shall be employed in any manufacturing establishment unless he has attended some public or private school under competent teachers at least twelve weeks, and, if under 12, six months, during the year next preceding, and ten hours constitute a day's labor. Gen. Laws, 1878, chap. 91, §§ 11 and 12.

In Massachusetts children under 12 cannot be employed over ten hours in any one day. Children between 12 and 15 must have attended school at least eleven weeks during the twelve months next preceding, and they must attend school at least eleven weeks during each year so employed. Gen. Stat. 1860, ch. 42; Laws of 1866, ch. 283; 1878, ch. 217. See also New York, 2 Rev. S. 98, § 2; Laws of 1876, ch. 372; Penna. Brightly's Purden, 452, §§ 1–6; Conn. R. S. 1866, tit. 13, ch. 4, § 50; New Jersey Laws, 1851, 321; California Gen. Laws, § 8650; Wisconsin Laws of 1877, ch. 289. Laws of 1878, ch. 187; Minnesota R. S. 1866, 228; Rhode Island G. L. 1872, 343, §§ 21 to 26; Swan and Critchf., Ohio, 824.

CUSTODY OF CHILDREN.

The subject of the custody of infants—the defects of the law in relation thereto, and how the same should be remedied, the apparent uncertainty in the application of the law to the different cases as they have arisen—has been the cause of long and elaborate treatises. Cases of conflicting interests and claims and unfortunate family differences have frequently occurred, calling for the interference of judicial authority, and without some study of the circumstances and facts of each case there would seem to be a greater conflict of decision than there really is. In these cases much is of necessity left to the sound discretion of the judge who hears the case; but there are some general principles which have been settled by authoritative decisions, and the controlling principle is that the court must carefully investigate the circumstances of each case, and act according to sound discretion and for the welfare of the child.

The Roman law gave the father absolute power over the persons of

his children, and according to some authorities over their lives and liberty, while the mother had no claim except for due reverence and respect.

The general rule of law in England was that the father had the legal power over his infant children, and during his life the mother had none. According to Blackstone, "a mother, as such, is entitled to no power, but only to reverence and respect." 1 Black. Com. 453.

And according to the common law the father had a right to the exclusive custody of his child, even at an age when it still required nourishment from its mother's breast. "It is the universal rule, with some exceptions, that the father is entitled to the custody of a young child even against the will of the mother" (*ex parte Glere.* 4 Dowl. P. C. 293), and this even though they be within the age of nurture (*Rex* vs. *Greenhill*, 6 Nev. and Man. 244; 4 Adolph and Ellis, 624). However pure might be the conduct of the mother, however amiable and correct in all the relations of life, the father might, if he thought proper, exclude her from all access to her children, and do this from the most corrupt motives. This state of the law which took so little account of the feelings of the mother continued until 1839, when an act was passed authorizing the interference of the courts for the protection of the mother and child.

Chancellor Kent states the general doctrine in this country as follows:

> The father may obtain the custody of his children by the writ of habeas corpus when they are improperly detained from him; but the courts, both of law and equity, will investigate the circumstances, and act according to sound discretion, and will not always and of course take a child, though under 14 years of age, from a third person and deliver it over to the father against the will of the child. They will consult the inclination of an infant if it be of a sufficiently mature age to judge for itself, and even control the right of the father to the possession and education of his child when the nature of the case appears to warrant it. 2 Kent's Com. 194.

Again, he repeats:

> The father, and, on his death, the mother, is generally entitled to the custody of the infant children, inasmuch as they are their natural protectors, for maintenance and education. But the courts of justice may, in their sound discretion, and when the morals, or safety, or interests of the children strongly require it, withdraw the infants from the custody of the father and mother, and place the care and custody of them elsewhere. 2 Kent, 205.

It is sometimes said that the right of the father to the custody of the persons of his infant children is in consequence of his obligation to provide for their maintenance and education. But this obligation of support is in some degree mutual under our laws, and there are cases where the obligation is shifted, and the child is bound for the maintenance of his parent; but we doubt if in such case the custody of the person of the parent would belong as of right to the child. In this country the right is, as a general rule, derived from the statutory enactments.

In this country, too, there is a great uniformity in the laws of the several States upon this subject, and the spirit of the decisions is essentially the same.

Where the question is to be determined by a judicial tribunal the courts are not bound to deliver the child into the custody of any claimant, but, in the exercise of a sound discretion, will leave the child in such custody as may appear best for it. Where there is a controversy between parents for the custody of their child, the right of the father is preferred to that of the mother, but the welfare of the child will be the criterion by which the custody is awarded. If the child have arrived at the age of discretion, in ordinary cases, upon *habeas corpus*, the court will permit the child to elect in whose custody it will be placed, but the court will take care that the custody is not an improper one. If the child is not competent to form a judgment and to declare his election, the court, after examination, will exercise its judgment for him.

For authorities upon this question we may refer to the following among many: *Matter of Woolstoncraft*, 4 Johns. ch. 80; *Matter of Waldron*, 13 Johns. 18; *People* vs. *Chegaray*, 18 Wend. 637; *People* vs. *Kling*, 6 Barb. 366; *Foster* vs. *Alston*, 6 How. (Miss.) 406; *Com.* vs. *Addicks*, 5 Binney, 520; *Ex parte Crouse*, 4 Whart. 9; *U. S.* vs. *Green*, 3 Mason, 482; *State* vs. *Smith*, 6 Greenl. 262; *People* vs. *Mercier*, 3 Hill (N. Y.) 399; *People* vs. *Wilcox*, 22 Barb. 178; *Wilcox* vs. *Wilcox*, 14 N. Y. Rep. 575; *Wellesby* vs. *Wellesby*, 2 Bligh (N. S.), 136; *Ex parte Skinner*, 9 Moore, 278; 2 Story's Eq. § 1341; Hurd on Hab. Corp. 528.

It sometimes happens that the father or, after his death, the mother may give the child to a third person, or may relinquish the custody of it until it arrives at full age, upon consideration that such party will adopt the child and care for it as his own, and that subsequently he or she, after a state of things has arisen which cannot be altered without risking the happiness of the child, may attempt to reclaim its custody.

Where this transfer is made under the laws relating to apprenticeship or the adoption of children, the parent would be barred from such a reclamation; but this is sometimes done without such statute laws or not in the mode prescribed by statute. It is easy to see that such an attempt at reclamation might be made under circumstances peculiarly unjust and aggravating, when the affections of both child and parents by adoption have become engaged, or where the father, by such an arrangement, while his child was of tender years and entirely dependent, might shift the burden of his care and support upon a third party, and when the child arrives at more mature years, and under the care and at the expense of his parents by adoption becomes capable of making some material return, the father by such recovery would secure to himself the benefit of the services and earnings of the child at the expense of those who had fitted him therefor.

There are, however, decisions, both in England and this country, to the effect that the father would not be bound by such a transaction, but may recover the custody of the child, even though the interests of the child had been promoted by the original transfer. Tyler (§ 187, p. 283) says that the better opinion is that the father in such case is not in a

position to require the interference of the court in favor of his controlling legal right as against the rights, the feelings, and the interests of the other parties, and cites *Pool* vs. *Gott*, 14 Law Rep. 269; *State* vs. *Smith*, 6 Greenleaf, 462; *McDowle's case*, 8 Johns. 328; *Com.* vs. *Gilkeson*, Wallace (Philada.) R. 194; *State* vs. *Barrett*, 40 N. H. 15. See also *Matter of Murphy*, 12 How. Pr. R. 513; Hurd on Hab. Corp. 537. The only American cases which he cites as against this doctrine are *State* vs. *Oliver*, 1 Harr. (Del.) 419; *Mayne* vs. *Bredwin*, 1 Halstead, N. J. Ch. 454. Hurd, however, in a note, cites various other cases on both sides, but evidently agrees in opinion with Tyler.

In the case of illegitimate children the mother has the right to the custody. *Hulland* vs. *Malkin*, 2 Wilson, 126; *Rex* vs. *Soper*, 5 Term R. 278; *Rosalina* vs. *Armstrong*, 15 Barb. 247; *People* vs. *Mitchell*, 44 Barb. 245; *Wright* vs. *Wright*, 2 Mass. 109.

In many of the States these general principles of the law have been supplemented by specific statute provisions for the protection of children.

In many of the States the exposure of an infant under 6 years by the parents or other person having the custody of such child with intent to abandon it, and in some cases exposure such as endangers health or limb of infants, is punished by fine and imprisonment. R. S. Maine, 1871, 828; R. S. Conn. 1875, 500, § 15; Comp. Laws Mich. 1871, 2075; 3 Stat. Tenn. § 4620; R. S. Wisc. 1858, 974, § 8; 3 R. S. N. Y. 937, § 45; Code Ga. 1873, § 4373; Wagner Stat. Mo. 451, § 39; N. Y. Laws of 1876, chap. 122.

In New York, where parents abandon their children they forfeit all claim to their custody as against any person who has taken, adopted, or assumed the maintenance of such child. (3 R. S. 166, § 11.) And in Georgia parental power is lost by consent to adoption, by voluntary contract releasing custody to third person, by failure to provide necessaries, by abandonment of family, by consent to marriage, and by cruel treatment. (Code of 1873, § 1793.) The Minnesota law authorizes any incorporated orphan asylum to take charge of destitute and abandoned children. (R. S. 1866, §§ 65, 66.) And in New York and other States there are various societies having this power, many of them organized solely for this object.

Abducting, enticing, or conveying away minors is also prohibited under penalty. R. S. Me. 828; Mich. C. L. 2075; Tenn. 3 Stat. § 4621; Ga. Code, §§ 4367–8; Mo. Wag. Stat. 451, § 38; So. Car. R. S. 711, § 15; and others.

In many of the States the furnishing or sale of spirituous or intoxicating liquors, wines, or malt liquors is covered by a general prohibitory law, applicable to all; but in some States special provisions have been enacted as to minors. N. Y. 3 R. S. 937, § 21; Iowa Code, § 1539; Ill. 1878, 528; Ind. R. S. 872; Mich. C. L. 702; Tenn. 3 Stat. § 4863; Minn. R. S. 208, § 10; Mo. Wag. St. 552, § 20; Penna. Purden, 666, § 31.

Again, minors under a certain age are prohibited from being admitted to or remaining in any saloon or place of entertainment where spirituous or malt liquors are sold, exchanged, or given away, or at any place of amusement known as a dance house or concert saloon, unless accompanied by parents or guardians. N. H. G. L. 1878, ch. 269, § 23; Cal. Stat. 1877–8, p. 813; Mo. Wagner, 213, § 8; Penna. Purden, 49, § 9, 501, § 20; N. Y. 3 R. S. 982, § 91; Ohio, Sayler's Stat. 271, ch. 264.

Gambling or betting with minors, furnishing them with dangerous weapons, or selling poisons to them is prohibited. Ohio S. and C. 667; Tenn. 3 Stat. §§ 4864, 4887; Mo. Wagner, 662, § 5; N. Y. 2 R. S. 921, § 44.

Children found begging or soliciting charity may be arrested and committed. N. Y. 2 R. S. 837, § 4; Cal. Stat. 1877–8, 813, § 4. And the general laws against gaming, begging, and vagrancy apply to minors as well as to adults.

In some of the States there are provisions similar to those found in the Florida statutes, in which stubborn children, runaways, and those who misspend their time by frequenting gaming houses or tippling shops are classed with disorderly persons, rogues, and vagabonds, and made subject to the same punishment. See Bush's Digest, 249, § 24. As to *stubborn children*, there is the spirit of the old colony law of Massachusetts, but with a strong modification of the penalty.

But, perhaps, sufficient has been said to show the tendency of the legislation on this subject.

Within the last few years another matter has received attention at the hands of the State legislatures.

In the laws of New York for 1874, chap. 116, it is provided that any person, whether as parent, guardian, relative, employer, or otherwise, having in his care, custody, or control any child under the age of 16 years, who shall sell, apprentice, give away, let out, or otherwise dispose of any such child to any person, under any name, title, or pretence, for the vocation, use, occupation, calling, service, or purpose of singing, playing on musical instruments, rope-walking, dancing, begging, or peddling, in any public street or highway, or in any mendicant or wandering business whatever, and any person who shall take, receive, hire, employ, use, or have in custody any such child for such purposes, or either of them, shall be deemed to be guilty of a misdemeanor, &c. 3 R. S. 164, § 9.

Again, in 1876, it was enacted that any person having the custody, care, or control of any child under 16, who shall exhibit, use, or employ, or in any manner or under any pretence sell, apprentice, give away, let out, &c., any such child to any person in or for the vocation, occupation, service, or purpose of singing, playing on musical instruments, rope or wire walking, dancing, begging, or peddling, or as a gymnast, contortionist, rider, or acrobat, in any place whatsoever, or for and in any business, exhibition, or vocation injurious to health or dangerous

to the life and limb, or who shall cause, procure, or encourage any such child to engage therein, shall be guilty of a misdemeanor. And upon conviction of such party the court or magistrate may, if he deem it desirable for the welfare of the child, deprive such person of its custody, and commit it to some orphan asylum, or make such other disposition of it as is or may be provided for by law. Laws of 1876, ch. 122.

Similar provisions of law are found in New Hampshire, Gen. Laws, 1878, ch. 269, § 24; California Laws of 1877-8, 813, act March 30, 1878; Pennsylvania, act of May 24, 1878; Illinois, Laws of 1876, chap. 122, revision of 1878, 496. And the same general provisions may perhaps be found in other States, whose later statutes we have been unable to examine.

In a case arising under the New York laws, Westbrook, J., says:

The right of the State to care for its children has always, and with very great propriety, been exercised. Under its laws, whenever the welfare of the child has demanded, its courts have frequently interfered for the protection of children of tender years. It has again and again taken them from one parent and given them to the other, or has refused so to do, the good and welfare of the child being the object always in view. It has so acted without the intervention of a jury, and that power has never been supposed to have been improperly exercised because a jury was not allowed and due process of law not had. If the courts of the State may, by virtue of their general powers, interfere for the protection and care of children, it is not seen why the legislature may not prescribe the cases in which children shall be rescued from their custodians and a mode provided for their summary disposition. For example, if children should be placed to learn the business of stealing, could not the legislature provide a summary remedy for the evil? Has the law no power to rescue, summarily, female children held for the purposes of prostitution, or interfere in an expeditious manner in very many cases when children of tender years are exposed to peril or temptation? This will hardly be argued, or, if claimed, authority most abundant can be found to justify it. Precisely this ground the act of 1876 covers. In my judgment it is a most wise, salutary, and beneficent statute, born of Christian civilization and founded upon the teachings of Him to whom children were objects of tender love and care. It needs no evidence to demonstrate to our judgment that the life to which these children were subjected and from which they were rescued was perilous to their best interests. It was dangerous to them physically and morally. The contortions, evolutions, and performances of the acrobat are clearly physically dangerous, and the surroundings and companions of the circus ring are equally so morally. In the matter of *Donohue et al.* N. Y. Sept. term, 1876.

SPECIAL PROVISIONS IN REFERENCE TO EDUCATION.

Under this head it is not proposed to do more than to call attention to certain specific provisions of law enforcing the duty of parents, guardians, and others having the custody of children to provide for their education and intended to prevent truancy.

It is well settled that a proper education is included in the term "necessaries." Whether a "proper education" is to be construed to include more than a good common school education is a question upon which the decisions are not harmonious. In *The College* vs. *Chandler*, 20 Vt. 683, the supreme court say:

A good common school education at least is now recognized as one of the "necessaries" for an infant. Without it he would lack an acquisition which would be com-

mon among his associates, and would ever be liable to suffer in his transaction of business. Such an education is moreover essential to the intelligent discharge of civil, political, and religious duties.

To this extent the courts are in accord, and the reason given in an English case was that it was for the benefit of the realm. *Manley* vs. *Scott*, 1 sec. R. 112.

In this country the education of children has been provided for by constitutional and statutory provisions for the organization of public schools, free to all within the scholastic age. Experience, however, has shown that the attendance upon the free public schools has never included all the children of school age. Parents have been found "so indulgent and negligent of duty in that respect," so regardless of the interests of their children, as to suffer them to grow up in ignorance and idleness, or so greedy for a little present gain that they are willing to sacrifice the future welfare of their children to obtain it, and especially in our large cities a class of children are found who prefer the unbridled license of the streets to the wholesome restraints of the school room.

To prevent this evil there have been added to the school systems of many of the States what are known as the provisions for compulsory education. The State, having provided a free gift for its children, has sometimes found it necessary to compel its acceptance.

These provisions are of two kinds, those that apply to parents or custodians of the children, the compulsory laws proper, and those that reach and apply to the children themselves, or the laws to prevent and punish truancy.

In many of the States there are some general provisions of law bearing upon this question. Vagrants and disorderly persons are placed under the ban of the law, and these are defined to include those who have no regular or lawful occupation, who misspend their time in idleness or frequent places of immoral tendencies, stubborn children, runaways, idle persons who go about begging, and the like. There are also laws providing for the arrest of vicious and unruly children, or of those suffered to run at large without proper restraint, and their commitment to some institution provided for such purpose, there to be employed at such suitable labor as they may be able to perform and to be educated and instructed so that they may make useful citizens.

The laws for the prevention of truancy reach all children of the prescribed age who do not attend school, and provide for their being placed in some proper institution to be educated and instructed until they are brought under proper restraint. These gather into the schools the street waifs who can be reached in no other way, and if they are not effective it is because they are not properly enforced.

In Maine, Massachusetts, and Rhode Island the truant question is referred to the towns, who are authorized to make by-laws respecting truants and children within a prescribed age not attending school, or who are without any regular or lawful occupation or growing up in

ignorance. The towns may annex suitable penalties for the breach of these by-laws and appoint special officers to enforce the same—a plan which has not proved eminently successful. R. S. Me. 186, §§ 13 to 15; R. S. Mass. chap. 42, § 84; Gen. Stat. R. I. chap. 57.

The other branch is perhaps more effective and reaches the larger number of cases. It declares the duty of the parent or custodian, and enforces that duty by penalties for the breach thereof.

These compulsory provisions are not original in the Massachusetts law of 1642, but would seem to have been borrowed from the same source as the laws in reference to stubborn children or those who should smite or curse their natural parents.

In an article on "The criminal code of the Jews," in a recent number of the Pall Mall Gazette, the writer says:

> It must be remembered that education was well advanced among the Hebrews, especially after the first or Babylonian captivity. A system of compulsory instruction had been introduced by Joshua, the son of Gamala. There was a school board for each district. Every child more than 6 years of age was obliged to attend the communal schools. Such importance does the Talmud attach to the training of the young that it enters into the minutest details upon the subject.

The duty of preparing them to become good and useful citizens was not neglected. The Bible was their moral and legal code, and the study of this was enforced. A Jew could not but be well acquainted with the leading principles of his legal code and their general application.

And the same writer says:

> A man who had not or had never had a fixed occupation, trade, or business, by which he earned a livelihood, was not allowed to act as judge. "He who neglects to teach his son a trade," say the rabbins, "is as though he taught him to steal."

The New Hampshire law requires parents, guardians, or other custodians of children between 8 and 14 years of age to send them to school at least twelve weeks in each year, six weeks of which at least must be continuous. With some variations as to age and time, the same law prevails in other States. Michigan, act 165, laws of 1871; California, act March 28, 1874; Conn. Gen. Statutes, revision of 1875, title xi, with amendments to 1879, § 1; Maine, act of 1875; Mass. laws of 1873, 279; 1874, 233; 1876, ch. 52; 1878, ch. 257; New York, laws of 1851, ch. 337, § 13; as amended, 1866, ch. 245; District of Columbia, R. S. D. C. ch. 12, § 1; Kansas, laws of 1876, ch. 92; Nevada, act Feb. 25, 1873; New Jersey, act April 9, 1875; Ohio, act of Sept. 1, 1877; Vermont, acts 1867, 1870, 1873; Wisconsin, laws of 1879; Arizona, act of Feb. 9, 1875; Wyoming, acts Dec. 12, 1873, and Dec. 15, 1877.

Washington Territory, by a law of 1877, applies a similar provision to all towns of 400 or more inhabitants. The constitutions of Colorado and North Carolina authorize such a law, but the legislatures do not appear to have acted upon it.

In Illinois the expense of the support and education of children are made a charge upon the property of both husband and wife, or either,

in favor of the creditor therefor, who may sue either one or both. Stat. 1876, 693, § 15.

In Georgia a general provision makes it the duty of the father to provide for the maintenance and education of his children during minority. Code of 1873, § 1792.

And this is the general requirement of the law. Where there is sufficient property of either parent or belonging to the child, courts of equity under the general rules of the law are authorized to interfere, to secure to the child a proper education where the natural or legal custodian neglects that duty. But under the special compulsory provisions there is no question of property. The free public schools offer facilities for education without charge to parent or child, and it is made a penal offense for the parent or custodian to refuse the facilities so offered to the child.

If it be true that a good common school education is recognized as one of the necessaries for an infant, and essential to the discharge of civil and political duties, or, as generally stated, that a diffusion of knowledge among the people is essential to the preservation of free institutions, these so called compulsory or obligatory laws are founded upon the right and duty of self protection and preservation. They belong to the class of laws which are intended for the suppression of vice. They are intended to reach and bring within the influence of our schools a class who cannot be reached effectually in any other way. Wherever they have been properly enforced, the evidence is that great benefits have accrued therefrom; and in a somewhat extended examination of the various school codes but one instance has been found where these compulsory provisions once adopted have been abandoned, and that is in the Texas school code of 1879. Even there there was no direct repeal, but the clause was omitted in the revision, and it would seem that it was sought to do by implication what they hesitated to do by direct declaration. The same revision narrows the school age from 6 to 16 down to 8 to 14, and deprives all children under 8 or over 14 of the privilege of free education. Whatever may have been the cause of this retrograde movement, there will be found little disposition in other States to follow it. In the two adjoining States, Arkansas and Louisiana, the school age is from 6 to 21, which may be termed the general school age of the country, and it can hardly be supposed that Texas parents will persist in depriving their children of advantages which would be their right in every other State. The simple question is whether it is better to educate the children for our jails and workhouses or to become useful citizens. In the one direction or the other they will be sure to go, and if left to themselves, especially in our large cities, a large class will take the wrong direction and render the problem before referred to more difficult of solution.

GENERAL SCHOOL LAWS.

Among the rights and privileges of children, and by no means the least important, is the right to the education provided for them under the public school system. In a former paper one branch of this subject, known as the compulsory education system, was introduced. It is now proposed to treat of the public free school system of the various States, and to give an abstract of the various State school codes, as brief as is consistent with a fair understanding of the same.

It has been said that there is no American school system. If this means that there is no national system adopted and prescribed by the Federal Government the statement is true. The power to establish and enforce a public school system is one which the people have never delegated to the General Government. On the contrary, they watch with great jealousy any act which shows an intent on the part of the Government to interfere with this subject. It is true that a national Bureau of Education has been established, but it has no governing authority. It is simply an office of information, and its chief function is to collect and disseminate information upon educational subjects. It appeals through the history of experience to the reason and sound judgment of the people. It brings home to them a knowledge of all that is done for education.

The American school systems as they exist to-day are the result of the independent action of thirty-eight independent States and of nine Territories, each acting for itself. The various statutes of these States and Territories relating to common schools would fill volumes. The result sought to be attained has been the same in all. In some of the older States it is the growth of over two hundred years of practical experience, and this experience has inured to the benefit of the younger States. In many instances the new States have undoubtedly improved upon the old, and the old States have shown their appreciation by adopting the improvement. Hence, instead of such great diversities as might naturally be expected from the separate action of so many independent authorities, it will be found that upon the material points there is a remarkable unanimity.

As a general rule the people are slow to allow or assent to changes in constitutional provisions, even when it is freely admitted that some changes are desirable. In almost every legislative body there will be found a class of statesmen who seem to have no doubt of their ability to improve upon any existing law or system, and the people seem to expect and submit to a certain degree of instability in the statute law. But when the proposition is to change constitutional provisions they must be satisfied that some urgent necessity demands the change ere they will consent to remove the legal restrictions which bar any alteration of the fundamental law, and as a general rule the change when proposed must be approved by the popular vote before it can become effective.

Hence, when permanency is desired they secure it by incorporating the proposed ordinances in the constitution. This is not, as some foreign writers seem to understand, a compulsory power wielded by the State against the free action of its citizens, but a voluntary binding agreement entered into by the citizens themselves, which controls or compels State action. The people are bound by the constitution which they have adopted until it shall be legally changed or modified, but one of its most essential functions is to restrict the legislative power in certain directions, while it at the same time compels action in others.

The idea lying at the foundation of the American school system is found in the apothegm, "An ignorant people may be governed, but only an educated people can govern themselves." The doctrine which has been incorporated into many of the State constitutions, and is the governing principle in all, is that "knowledge and learning as well as virtue generally diffused throughout the community is essential to the preservation of a free government and of the rights and liberties of the people." Hence, for the protection and perpetuation of free government, they have inserted in their State constitutions provisions requiring the legislatures to establish and provide for the maintenance of an efficient and uniform system of public schools, free to all children of the State within the school age.

Many have gone further than this and provided for the setting apart of a special State school fund, the principal of which is not to be diminished, the interest on which is pledged for the support of schools and forbidden to be used for any other purpose, and in addition an annual State appropriation or the levy of a special State tax is usually made for the same purpose. In many States the provision is required to be sufficient to support a school or schools in every district for a certain specified time each year as a minimum limit.

In many of the State constitutions there are provisions for the appointment of supervisory officers, who are to have charge of the educational interests of the State, and in the constitution of Virginia the provisions substantially establish the system, leaving but little except details to be provided for by the legislature.

Another general principle, constitutional or statutory, is that the public schools shall be free from all sectarian or denominational influences. As enumerated in the constitution of Massachusetts, "humanity and general benevolence, public and private charity, industry and frugality honesty and punctuality in dealings, sincerity, good humor, and all social affections and generous sentiments" are to be inculcated, but sectarian or denominational teaching is rigidly excluded from the schools or school books. Perfect freedom of religious belief is the right of every citizen. He may adopt any form of religious belief which approves itself to him or he may reject all forms. He may bring up his children to believe in the teachings of any sect or creed, but he must provide for this outside of the public school. He cannot require others entertain-

ing different and frequently radically conflicting opinions to contribute to the inculcation of his own particular tenets. The public school is the neutral ground, free to all creeds and forms of belief, upon which the most discordant elements may meet and enjoy equal rights and privileges, a result which perhaps cannot be fully attained except by a secularization of the public schools.

In the matter of school statistics the provisions of the State codes are almost identical. At stated periods there is required from some school district officer a census of all persons residing in the district of the school age, some even requiring names, age, and sex. This is the school material. In every school a register is required to be kept by the teacher of the name of every pupil attending from day to day, and at stated periods reports are to be made showing the actual attendance of each, with the average attendance for the period, and unless these reports are made the teacher forfeits his pay. A comparison of these two shows the names of all who are denied or who neglect to avail themselves of the benefits of the school privileges. From each district must also come a statement of the number of schools, the length of time and by whom taught, their management and comparative condition, the wages of the teachers, with a complete statement of the financial condition of the district, the sources from which its funds were derived, and the cost per scholar. So specific are the details required that the reports furnish a complete annual history of the operations of each district.

Again it is made the duty of certain officers to visit the schools and examine into their condition and management and report upon the same. This is made peremptory upon the officers, beginning with the district and running up to the town or county and in some degree to the State supervisory officers. The theory of the law requires a careful study of the workings of the system, with a series of reports thereon which finally reach the legislature through the State superintendent or State board.

In all the States and all the Territories, except Alaska, which has no public school law, and New Mexico, where the provisions are extremely crude, the general supervision of educational interests is vested in a State or territorial superintendent, with or without a State board of education. In Connecticut, Massachusetts, and Texas the substantial duties of State superintendent are devolved upon the secretary of the State board, and in Maryland, upon the principal of the State Normal School, who is ex officio a member of the State board.

The State boards in some cases are merely the trustees of the school fund, and have the care and management of the school lands; in some their functions are simply advisory upon matters referred to them by the State superintendent, while in others they are charged with the general supervision of the school system, with power to make and enforce rules and regulations for the government of the same.

The State superintendents, with or without the direction of the State boards, are charged with the general supervision of the educational interests of the State and with the administration of the school laws. They are to advise with and instruct the county superintendents and other subordinate school officers, to prepare forms and blanks for reports and returns, examine into the workings of the system, collect statistics and information, devise plans for the improvement of the schools, and generally make themselves familiar with the wants and necessities of the system, and make full reports to the governor or legislature. They have also general supervision of the State normal schools and institutes for the education and instruction of teachers, and apportion the State school moneys to the counties or towns, in the mode provided by law.

In all the States outside of New England, except Michigan and Ohio, which seem to have adopted substantially the New England system, and Delaware, where there is no present provision in the law for any officers between the State superintendent and district boards, there are county superintendents or county boards or both, the parish boards of Louisiana corresponding to the county boards in other States.

These county boards or county superintendents generally occupy the same position with reference to the county schools as the State superintendent does to those of the State, but subject to the State superintendent. Under the New England system, the town school committees or supervisors perform the duties in their several towns which in the States which have adopted the county organization is performed by the county authority. Where the county is made the source of power, it is generally made the duty of the county authority to divide the territory into convenient subdistricts and establish in each a sufficient number of schools for the accommodation of all children of school age. In these States the duty of providing for the schools beyond the State provision is imposed by law upon the county, or the county and school district, while in New England and some of the other States the town or township is the head, and upon it is imposed the duty of providing for the support of the schools.

The school district is a territorial division of a county or town, which is recognized in all the States except Texas, where it simply includes families sending to a school.* Under the laws of the New England States, while the towns were to a certain extent required to provide for the support of the schools, they were also to be divided into school districts, the extent and boundaries of which were to be determined by the town. The districts so formed were, for school purposes, independent municipal corporations. The town was required to levy a tax for the support of the schools, which was to be distributed to the several districts as provided by law or as it might direct. Aside from this the district might vote such additional tax as it saw fit for the same purpose. It provided its school-houses, fixed their location, determined the time when the schools should commence and close, whether they

should be taught by male or female teachers, and managed its own affairs through its own officers. For a certain length of time it was bound to keep up its schools under competent teachers. The town school committee determined who were competent teachers and had the general supervision of the schools. If the district neglected or refused to perform its statutory duties the town or its committee might interfere, employ teachers, and establish and keep up the schools at the expense of the town or district. The present laws, however, in several States, authorize the towns to abolish the district system and assume control of the schools, and for that purpose it becomes the district; and in Massachusetts the town system has been substituted for the old district system in the larger part of the State. In many of the States outside of New England the law makes the city, borough, or township the school district; and in States where the county is to be divided, the formation of districts too small in means or population to be effective is sought to be avoided by forbidding the laying off of any district unless it contains a minimum number of children of school age.

The Texas school law of 1879 virtually abolishes school districts as territorial divisions and substitutes in their place what are called "school communities," which would seem to be associations of individuals, covering the same territory, like church or other associations, without other limitation than that in towns of less than 1,500 inhabitants but two such communities can be formed for whites and two for colored. This is a new invention as applied to the school system, and what its effect may be remains to be seen.

Another point upon which all the school laws are in unison is the necessity of providing means to secure competent and qualified teachers. The early requirements were evidence of good morals and a satisfactory examination before some authorized board or officer as a condition precedent to employment. It was discovered, however, that the possession of knowledge and the faculty of communicating it to others did not always accompany each other; that teaching was of itself a science to be taught; and hence there have been added to the common school system State normal schools for the training of teachers, and State and county teachers' institutes, which the teachers are in most cases required to attend, the object of which is the improvement of the methods of teaching and to raise the standard of teachers' qualifications. In this way the States have not only undertaken the education of the children, but also provided for the instruction and education of the teachers.

Another universal requirement is that the schools shall be taught in the English language. The teaching of other modern or ancient languages is not prohibited, but on the contrary it is authorized under certain circumstances; but they are taught simply as a branch of study, and are not the language of the school. It has been said that one of the most remarkable features and the greatest work of the free school is its power of assimilation. It draws together the children of all races and

stamps upon them the mark of nationality. It is described as a mill, into which go children of all nationalities and come out Americans. In the new constitution of Louisiana, however, while it is provided that the schools shall be taught in the English language, it is also provided that in parishes where the French language predominates they may also be taught in the French language.

If this is to be carried out, one manifest result must be the division of the school day between the two nationalities, which will of course shorten the school period for both, unless the school term is lengthened in proportion, which in city schools kept up for ten months would be impossible.

Mr. Francis Adams, in his work on the American school system, says:

> The most conspicuous feature of the American school system is its representative character. The doctrine of the sovereignty of the people, pervading all American social and political organizations, is carried to its fullest limit in the schools of the country. The principle to which the people are most attached is thus fitly exhibited in the institution upon which they set the highest value.

Again he says:

> The widespread popular regard which constitutes the propelling power appears to be chiefly due to two features: government by the people and ownership by the people. It is a vast proprietary scheme, in which every citizen has a share. For no reason is the principle of local government more dearly prized than because of the control which it gives the people over the schools. They would be as ready to surrender all municipal powers and privileges as to transfer their management to a sect or to any other private organization. This recognition of responsibility is the mainspring of the system and the cause of its best results. * * * The simple principle of the American school laws is that the people can be trusted to attend to their own business.

Bishop Fraser, another English writer, says:

> Local self-government is the mainspring of the American school system.

Under the New England system the district was the chief source of power. The people had ordained that there must be each year a certain amount of school facilities furnished. Beyond that point the qualified voters of each district were free to act according to their discretion. The majority could extend their schools, divide them into different grades, add to the branches to be taught, build such houses as seemed best to them, the only limit being the amount for which they were willing to tax themselves. In Maine, if the majority proved to be too parsimonious, and refused to vote such sum as in the opinion of the minority it was necessary to raise, the minority were authorized to appeal to the town, and upon such appeal the town might overrule the majority and increase the amount.

This attachment to local control of the schools is undoubtedly one great reason why the people hold so tenaciously to the old district system in the New England States. This principle of local government, however, exists in a majority of the States to a greater or less extent, but in some there will be found school systems where it appears that this principle is not yet fully developed.

distribute blanks for school returns, publish and circulate the laws and regulations concerning common schools, visit, if practicable, each county annually, and report to the governor the number of school districts, the number of schools taught, the number of scholars taught and number of children of school age, the amount of school funds received and expended, with a statement of the condition of the schools and with such suggestions and recommendations as he may deem proper. He is to apportion the school moneys to the counties, and keep special accounts with each county and township.

These may be termed the usual duties of the State superintendent.

The county superintendent has general charge and supervision of the schools of the county. In addition, he is to receive, disburse, and account for all county school moneys, apportion the same to the districts, and pay teachers. He is to report to the State superintendent annually, and oftener if required. In connection with two teachers of the county, appointed by himself, he is to examine teachers and conduct teachers' institutes.

In 1878 the district trustees had the immediate supervision of the schools in the district. They were to establish one or more schools for each race, as necessity might require. They were to contract with the teachers to pay a pro rata share of the school fund apportioned to the district according to the number of days' attendance shown in the teachers' report, payment to be made at the expiration of the year, but could not contract for less than three months nor for less than ten pupils of the scholastic age. They were forbidden to draw any warrant in favor of any teacher whose annual report showed an average attendance of less than ten scholars. They might remove teachers, but must allow a pro rata share of the fund at the time of the annual payment. Each two years they were to take enumeration of all children in the district between 7 and 21 years of age and report to county superintendent. These duties in 1879 were to be devolved on the township superintendents before mentioned, with some modifications.

The scholastic year begins October 1 and ends September 30 following. The school month is 23 days, the school day not less than 6 hours.

Districts.

Every township and fraction of a township divided by State or county lines, "or any other insuperable barrier, such as rivers, creeks, or mountains," and every incorporated city or town of 3,000 inhabitants, shall constitute a separate school district.

Every child between 7 and 21 years of age is entitled to admission into, and instruction in, any public school of his own race or color in the township of his residence, or in any public school of his race or color in the State.

In the apportionment of the State school fund the necessary amounts

for contingent expenses and State normal schools are to be first set apart.

Each township is to receive the amount due from the sixteenth section or other trust fund held by the State. Townships having an income from trust funds are not to receive any part of the apportionment until other townships or districts having no trust funds shall have received such sum as will give them an equal share per capita with those having such trust funds.

Each county shall receive the poll tax collected in it, and each race is entitled to the poll tax paid by it.

For Mobile County a board of nine commissioners is provided, one-third to be elected biennially. This board is to elect a president, vice president, and superintendent and to have control and management of the schools. They have full power to continue in force, revise, modify, and improve, as to them may seem fit, the public school system existing in the county. They are made a body corporate, are to receive, assess, and collect all devises, revenues, and taxes for support of the schools, and purchase or lease all property necessary for school purposes and for the proper accommodation of pupils and teachers, the superintendent to have supervision of the schools.

The last general revision of the school law allowed the trustees to select teachers without reference to examination, but a subsequent amendment requires teachers to be examined by a county educational board. Under the restrictions imposed upon the payment of teachers no one can adopt teaching as a means of living unless possessed of sufficient funds to maintain himself for the first year. There is no pay until the expiration of the year, no matter how brief a time the teacher is employed, and even if the teacher has served the full year he may find himself entitled to no compensation if, upon the final summing up of his report, the average attendance is less than the minimum allowance. If this is to be continued the attendance should be made compulsory, under penalties sufficient to indemnify the teacher against any possible loss on account of non-attendance.

ARKANSAS.

Article XIV of the constitution requires the legislature to maintain a general, suitable, and efficient system of free schools whereby all persons in the State between 6 and 21 years of age may receive gratuitous instruction. It also requires that it shall provide by law for the support of schools by taxes, not to exceed two mills on the dollar in any one year and by an annual per capita tax of $1 on every male inhabitant over 21, and provides for a general law authorizing school districts by a vote of the qualified electors to levy taxes for school purposes not to exceed five mills in any one year.

The school code of 1875, as now in force, provides for the election of a State superintendent biennially, with the usual powers and duties. He is also to prepare and furnish to the county examiner suitable ques-

been maintained. County school money may be used for any purpose authorized by law, but all State moneys, less 10 per cent. for library, are to be applied exclusively to the payment of teachers.

Writing and drawing paper, pens, ink, and lead and slate pencils for the use of the schools are furnished under direction of the trustees and paid for out of district fund. Books for the children of indigent parents may be also furnished.

Each county, city, or incorporated town, unless subdivided, forms one school district. Each district is designated by name and possesses corporate powers.

Every elector of the county who has resided in the district thirty days is a district voter.

The school census of each district is to be taken annually in June by a census marshal appointed by the trustees. The school year begins July 1, and the school month is four weeks of five days each.

Every school, unless otherwise specially provided, must be open for the admission of all white children residing in the district between 5 and 21 years of age. Children of African descent or Indians are to be taught in separate schools, but if separate schools are not provided they shall be admitted to the other schools.

Unless otherwise specially provided, the schools are to be of three grades, no school to continue in session over six hours a day, and pupils under 8 years are not to be kept over four hours; pupils are admitted in the order of registry.

In cities having graded schools beginners must be taught by teachers of at least four years' experience.

Ten per cent. of the State school fund apportioned to the district, not, however, to exceed $50, together with any sum added thereto by donation, is to be expended annually by the district board for library and apparatus. Libraries are to be kept in the school-houses when practicable and free to all pupils of suitable age. Any member of the district may become entitled to the privileges on payment of life membership or such monthly fee as may be prescribed.

The county school tax is to be estimated at $500 for each teacher in the county, deducting therefrom 90 per cent. of the State fund apportioned. The board of supervisors must levy the county school tax, not to exceed 50 cents on each $100, and not less than $3 for each census child. If the supervisors fail to levy, the auditor must add the amount to the assessment roll.

The district may by vote raise an additional tax not to exceed 70 cents on each $100 for building purposes in any one year, and not to exceed 30 cents for other purposes.

The State school moneys are apportioned to the counties in proportion to the number of children 5 to 17 years old. The county superintendent apportions to the districts according to the number of teachers, estimating one teacher to each 100 census children or fraction not less than 15,

$500 to each teacher. Districts having over 10 and less than 15 census children receive $300. Any balance remaining goes pro rata to districts having over 50 census children.

To entitle a district to the apportionment there must have been at least six months' school the preceding year, the prescribed text books and course of studies must have been used and teachers holding legal certificates employed.

Female teachers are to receive the same compensation allowed males for like services, and women are eligible to school offices.

Parents or guardians having control of children between 8 and 14 years of age are required to send them to school at least two-thirds of the time the schools are taught. Parents of children deaf and dumb or blind are to send same to State institution for such classes for not less than five years.

Teachers' institutes are held in each county of 20 or more districts annually, and in other counties at discretion of county superintendent. The sessions are to be not less than 3 nor more than 5 days, and teachers are required to attend, and $100 may be used for expenses.

COLORADO.

Article IX of the constitution requires the maintenance of a uniform system of free public schools throughout the State, wherein all residents between 6 and 21 years of age shall be educated gratuitously, one or more schools to be maintained in each district at least three months in each year.

It also provides for a State board of education, to consist of the State superintendent, secretary of state, and attorney general, a county superintendent in each county to be elected for two years. The legislature is to provide for the organization of school districts of convenient size, in each of which shall be a board of three or more directors, to be elected by the qualified voters of the district, who shall have control of instruction in the public schools of their districts.

The school laws are compiled to 1877.

The State and county superintendents are elected biennially at the general election, with the usual powers and duties.

The districts are divided into three classes: Those containing a school population of over 1,000 are of the first class; those containing a population of less than 1,000 and not less than 350, of the second class; and those of less than 350, of the third class.

Districts of the first class are to elect a board of six directors, and those of the second and third class, three directors, with terms so arranged that one-third shall be elected each year.

Voters at State elections who have resided in district 30 days may vote in district meetings. No resident is denied the right to vote on account of sex.

Each organized district is a body corporate. New districts may be

formed on petition of parents or guardians of not less than ten children of school age.

The district board may employ and dismiss teachers, fix and pay their salaries; prescribe rate of tuition for non-residents, the course of study exercises, and text books to be used; enforce rules and regulations of State superintendent, the length of schools in excess of three months, the number of teachers to be employed, the time for opening and closing the schools; require all pupils to be furnished with the prescribed books; provide books for indigent children and exclude all sectarian books. Text books once prescribed are not to be changed for four years

The school boards of districts of the first and second class may establish high schools and determine the qualifications for admission thereto.

Teachers must hold license from State or county authority.

A public school is one that derives its support wholly or in part from money raised by State, county, or district tax.

Every public school must be taught in the English language, and, except the high schools, be open at least three months in each year for the admission of all children of school age resident in district.

The school year begins September 1. The school month is 4 weeks of 5 days of not more than 6 hours each. The school age is over 6 and under 21 years.

The scholastic census is to be taken by the secretary of the district board annually.

Teachers' institutes are to be held in each judicial district when the county superintendents of two or more counties in the district give assurance to the State superintendent that at least 25 teachers desire to attend one, and $100 may be applied annually for expenses.

CONNECTICUT.

The constitution provides for a school fund, the interest of which is to be applied to the support of the public schools for the equal benefit of all the people of the State, and prohibits it from being diverted to any other purpose.

The laws as in force in 1879 provide for a State board of education, consisting of the governor, lieutenant governor, and four persons chosen by the legislature—one from each congressional district—for four years, one to be elected each year.

The board has the general supervision of the educational interests of the State and appoints a secretary who acts substantially as State superintendent.

There is no county school organization. Each town, at its annual meeting, elects a board of school visitors, consisting of 3, 6, or 9, one-third to be chosen each year for the term of 3 years, and the town may vest the employment of teachers in this board.

The board are to choose a chairman and secretary and have power to prescribe rules for the classification, management, discipline, and studies

of the public schools, and, subject to the State board, determine the text books to be used. They are to examine and issue certificates to teachers, and may appoint acting school visitors, to consist of the secretary and one or more of the members of the board.

Each town has power to form, alter, unite, or dissolve school districts, but no new district can be formed unless it contains 40 children of school age. Any town may, by vote at annual meeting, abolish all school districts and assume the control of all the schools therein, and for this purpose shall constitute a single school district.

School districts are bodies corporate and hold annual meetings. Qualified voters in the town resident in district are voters, and shall choose a district committee of not more than three, who are the executive officers of the district, and are annually to take census of all children in the district between the ages of 4 and 16.

Public schools are required to be established in every district for at least 30 weeks in each year where the number of persons of school age is 24 or more and at least 24 weeks in other districts. No school is required to be maintained where the average attendance is less than 8.

The schools are to be open to all children over 4 years of age, but the board of visitors may exclude all under 5 years. No person is to be excluded on account of race or color.

If the districts neglect to employ teachers and keep open a school, the board of visitors are to do so, and the expense is to be paid by the town.

Each district or town maintaining a high school, which shall raise by tax or otherwise $10 or more for a library in any year, shall be entitled to receive in addition $10 from the State, and the board of visitors are to select the books therefor.

Districts have power to vote taxes for school purposes, but no district is entitled to any share of the State fund unless a school has been kept up as required by law during the preceding year.

DELAWARE.

The constitution requires the legislature to provide by law for establishing schools and promoting arts and sciences.

The school laws as amended to 1875 provide for a State board to consist of the State superintendent, the president of Delaware College, and the State auditor. The State superintendent is appointed annually by the governor.

The State board are to hear appeals and determine finally all matters of controversy between the superintendent and the commissioners or teachers or between commissioners and teachers, prescribe text books, issue uniform series of blanks for use of teachers, and require records to be kept and returns made in accordance therewith.

The State superintendent is charged with the usual duties and is to

engage in no other business. He may also examine teachers, grant certificates, and suspend or withdraw the same for cause, subject to appeal to the State board. The certificates are not to be available until a fee of $2 is paid to the county treasurer and the certificate countersigned by him. The State superintendent may redistrict or consolidate districts in Sussex County, but not interfere with consolidated districts or incorporated boards.

At the annual stated meeting of each district, after the first, one of a board of 3 school commissioners[1] is to be elected for a term of three years. This provision does not apply to Wilmington or to districts 45 and 46 in New Castle.

The school commissioners shall annually, without regard to any vote therein, levy and collect $100 in each district in New Castle and Kent Counties and $60 in each district in Sussex for the support of schools.

The commissioners are to make assessment lists for their districts of all white male inhabitants, receive and collect all moneys of the district, select sites, lease or purchase necessary grounds or buildings, and provide schools for the district when and as long as the funds will enable them to employ teachers.

Teachers are to hold certificates of State superintendent; but this does not apply to schools or districts controlled by an incorporated board, unless by special request of such board.

The act provides that the districts shall remain as constituted at the time of its passage, but they might be altered or divided by the levy court; but no district should be divided unless each part should contain 35 scholars over 5 years of age. Two or more districts may unite for the support of schools for their common benefit.

The stated meeting of the district is to be held in April each year. The district has power to determine by a majority vote what sum shall be raised for school purposes. If the majority so vote, it may be raised by tax; otherwise, by subscription. The tax is not to exceed $400, exclusive of the fixed sum required to be levied without reference to vote. Districts No. 9 in New Castle County and No. 3 in Kent may raise $500 and No. 5 in Kent $400 by taxation. Any district raising $300 by tax may levy such further sum as may be required for a good school therein, on the rate bill system, by quarterly apportionment on the persons sending scholars to school. Any district which shall raise $25 in any year by tax or subscription may draw its proportion of State school money.

The State school fund consists of the surplus revenue, 5,000 shares Farmers' Bank, loan of $80,793.83 to the P., W. & B. Railroad, and loan of $5,000 to Sussex County, the clear income to be divided equally among the counties. The income of other stocks and securities belonging to the fund, fees for marriage and auction licenses, and other income

[1] These commissioners are termed also a school committee.

of said fund to be distributed to the counties in proportion to the population by the census of 1830, after deducting $30 from share of each county for printing for school convention; the city of Wilmington is to receive one-seventh of the share of New Castle County.

The schools are to be free to all white children over five years of age.

By special act the city of Wilmington is made an independent district, controlled by a board of education of two from each ward. The board are given corporate powers; may rent, purchase, or build houses, and do all acts necessary for instituting and sustaining schools, and may increase the number until they are sufficient to accommodate all white children.

There was no law providing for the education of colored children until the act of March 24, 1875.

By that act the levy court was required to levy annually a tax of 30 cents on each $100 of the assessments of real and personal property and polls of colored persons as they stand on the lists, the proceeds of the tax to be set apart as a separate and distinct fund for the support of colored schools in the State. This fund was to be paid over to the Delaware Association for the Education of Colored Children and applied by them to the support of colored schools, each county to have the benefit of the amount collected in it.

A subsequent act prohibits the use of any part of this fund by the association for the payment of salaries or expenses of its officers.

FLORIDA.

The constitution declares it to be the paramount duty of the State to make ample provision for the education of all children residing within its borders without distinction or preference, and requires the legislature to provide a uniform system of common schools; for a university and the liberal maintenance of the same; instruction in both to be free.

In addition to the income of the State fund, it requires the levy of an annual State tax of not less than one mill on the dollar and an annual county tax of not less than one-half of the amount apportioned from the State fund. No district is to be entitled to any apportionment unless a school has been sustained therein at least three months.

The school code, as in force in 1877, provides for a State board consisting of the State superintendent, secretary of state, and attorney general.

The State superintendent is appointed by the governor for four years, and is ex officio president of the State board.

The State board has charge of all school lands and funds, and is to use appropriations to the university or seminary fund in establishing one or more departments of the university, commencing with a department of teaching and a preparatory department, to which each county may send pupils in ratio of number of representatives, free of charge

for tuition.[1] It is also to decide upon questions and appeals referred to it by the State superintendent.

The State superintendent is charged with the usual duties of supervision of school interests and apportionment of funds, and is to entertain and decide upon appeals, or refer the same to the State board, as well as to prescribe text books and rules for the management of the department of education.

The county board consists of not more than five, to be appointed by the State board, on nomination of the State superintendent, upon recommendation of the representatives of the county.

The county superintendent is appointed by the governor, with other county officers, for a term of 2 years, and is to serve as secretary and agent of the county board, is to inspect county, ascertain localities in which schools should be established, the number who will attend each, and amount of aid citizens will contribute, present plans for school buildings, and visit and examine schools.

The county board hold and manage all property acquired by county for educational purposes, select sites for school-houses of not less than one acre in rural districts and as near that as possible in cities and villages, purchase, rent, construct, and repair school-houses, locate and maintain schools to accommodate as far as possible all youth between 6 and 21 years of age, employ such teachers as may be satisfactory to the local trustees, grade and classify pupils, establish schools of higher grades when the advancement and number of pupils require, establish and maintain school libraries, apportion school moneys to the districts in proportion to the average attendance, examine teachers, and do all acts necessary for the promotion of the educational interests of the county.

The district trustees are to consist of one and not more than three persons. They are to be recommended by the patrons of the school, selected by the county superintendent, and appointed by the county board, and have special charge of the schools for which they are appointed.

Each county constitutes one school district. Any county or school district neglecting to support a school for three months in the year forfeits its proportion of the State fund.

The county school tax is not to exceed one-half of 1 per cent. in any one year.

Teachers' certificates are granted by the State board, State superintendent, and county board, or by county superintendent when authorized by county board. Certificates may be suspended by the county superintendent and annulled by the authority issuing the same.

The school day is not to exceed six hours; school month, 22 days; school term, 3 months; school year, 3 terms.

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[1] Neither of these departments had been established up to the close of 1878, nor apparently in 1879.

The tax assessor is every four years to take census of children between 4 and 21 and between 6 and 21, reporting all deaf-mutes.

GEORGIA.

The constitution of 1877 provides for "a thorough system of common schools," "as nearly uniform as practicable," to be sustained "by taxation or otherwise," and to be free to all the children of the State, but limits the instruction to be given in them to "the elementary branches of an English education only," and requires separate schools for the white and colored races. This last is the only constitutional provision of its kind thus far except in Alabama and Texas.

The school law is the act of 1872 as subsequently amended.

The governor, secretary of state, and State school commissioner constitute a State board, who are an advisory body with whom the State commissioner may consult; also a body in the nature of a court to hear appeals from the State commissioner on any question of construction or administration of the school laws, their decisions to be final and conclusive.

The State commissioner is appointed by the governor, with consent of the senate, and charged with the general duties pertaining to the office. He is to apportion the State school revenue to the counties, upon the basis of the number of youth between 6 and 18 and of confederate soldiers under 30 years of age. His report is to include the statistics of private schools and colleges, as well as those of public schools.

The county board consists of five freeholders—3 to hold for 2 years and 2 for 4 years—who are selected by the grand jury. The county board appoints a secretary, who is to act as county commissioner, with a term of four years.

The county boards are to lay off the counties into subdistricts, and may alter these when necessary. They have the same control of the schools as the county boards in Florida. But where the counties are subdistricted they must appoint 3 intelligent and upright citizens of each subdistrict to act as school trustees for their subdistrict, to serve at first for one, two, and three years, one being subsequently appointed each year.

The county commissioner is to examine teachers, and when approved recommend to county board for license; he is the medium of communication between subofficers and the State commissioner and has general supervision of the schools.

The county board may establish evening schools for the instruction of youth over 12, and may organize one or more manual labor schools in each county on such plan as will be self-supporting. Ambulatory schools are also provided for in counties with sparse population, to continue for 2 months each in contiguous neighborhoods, and to have their terms successive, so that one teacher may serve several schools.

Each county is one school district. Any city of over 2,000 inhabitants or any county, under authority of the legislature, may organize a

public school system independent of this system, but the same reports are required of them as of other districts.

The school census is to be taken every four years, to embrace all children between 6 and 18.

The academic and calendar years are the same. The minimum school term is three months each year.

Admission to all public schools of the State is gratuitous to all children residing in the subdistrict in which the school-houses are located. Schools for white and colored children are to be separate, but, so far as practicable, equal facilities are to be secured to both in respect of the abilities of teachers and length of time taught.

ILLINOIS.

Article VIII of the constitution requires the general assembly to provide a thorough and efficient system of free schools whereby all children of the State may receive a good common school education.

Laws to 1879.

A State superintendent of public instruction is elected by the people every four years and is charged with the usual powers and duties. A county superintendent is also elected for four years, with general supervision of county schools and to have charge of school lands therein.

Every congressional township is made a township for school purposes under control of a board of three trustees, to be elected by legal voters; term of office, 3 years. Must be 21 years of age and residents of township. No two, when elected, to be residents of the same school district. Women over 21 are eligible. Board vested with perpetual corporate powers. Meetings to be at least semiannual.

They are to lay off township into one or more districts, and upon petition of 50 voters establish high school. School fund to be apportioned to district in proportion to number of children under 21; in new districts set off from older ones, in proportion to the amount of taxes collected in them the year before the division. Trustees to report to county superintendent usual school statistics.

Annual meeting of school districts to be holden in April each year. A board of three directors to be elected for 3 years' terms, one each year, subject to change or reëlection.

The directors may levy a tax annually, not to exceed 2 per cent. for educational and 3 per cent. for building purposes, for establishing and maintaining schools for not less than 5 nor more than 9 months each year, and defraying expenses of same. After necessary school expenses are paid they may appropriate surplus to libraries and apparatus. The directors and not the district are the body corporate.

They are to establish and keep in operation for at least 110 days a sufficient number of schools for the accommodation of all children over 6 and under 21, and shall secure to such children the right and oppor-

tunity for an equal education in such schools;[1] may adopt and enforce necessary rules and regulations; appoint all teachers and fix their compensation; assign pupils to the several schools; direct studies and text books to be used; shall strictly enforce uniformity of text books, but not permit changes in same oftener than once in four years; no child excluded on account of color.

No teacher to be employed unless he holds proper certificate. Teachers' wages are payable monthly on return of report; not required to teach on Saturdays or legal holidays, nor to make up time of special holidays ordered by directors. School month, calendar month.

The State common school fund consists of 2 mills tax, 3 per cent. of net proceeds of sales of public lands, and interest on surplus revenue fund, to be apportioned to counties on the first Monday of January each year by the State auditor.

In school districts of over 2,000 inhabitants, instead of directors a board of education of 6 may be elected, with 3 to be added for every additional 20,000 inhabitants.

In cities of over 100,000 inhabitants the schools are under the control of a board of education, with a city superintendent. The purchase of lots and erection of houses to be with the concurrence of the city councils.

The presidents or principals of all colleges, academies, and educational institutions to report to State superintendent. The State superintendent may visit all educational and charitable institutions, and superintendents of same are to report to him.

State and county normal schools are established and provided for.

INDIANA.

Article VIII of the constitution declares that "knowledge and learning, generally diffused throughout a community, being essential to the preservation of a free government, it shall be the duty of the general assembly * * * to provide by law for a general and universal system of common schools wherein tuition shall be without charge and equally open to all."

Laws to 1879.

The State superintendent is elected for two years and has general supervision of State system.

The governor, State superintendent, the presidents of the State University and Purdue University, principal of State normal school, and superintendents of the three largest cities to constitute State board of education, of which the State superintendent is ex officio president.

The county superintendent is elected biennially by vote of township trustees in convention, and, with township trustees, constitutes county board of education.

[1] Exclusion of children on account of color is expressly forbidden.

Each civil township and each incorporated town or city are school districts with corporate powers.

The common council of each city and board of trustees of each incorporated town, at their first meeting in June each year, are to choose school trustees to serve three years, one to be chosen each year.

The school trustees are to organize by the election of a president, treasurer, and secretary of their own number.

Trustees are to receive revenue and keep account of same; to take charge of school affairs of township; employ teachers; procure or build houses and furniture; establish and grade schools; and have care and management of all school property. In incorporated cities or towns may employ superintendent, and trustees of two or more municipal corporations may establish joint graded schools. May levy tax for any school purpose, except tuition, not to exceed 50 cents on $100, and $1 poll tax, and are to make annual enumeration of children between 6 and 21, distinguishing between white and colored. All taxpayers of the district and persons transferred for school purposes are voters at school district meetings, except minors and married women. The voters are to meet annually in October and elect a director who is a voter, and may determine time school is to be taught and what additional branches.

The school year begins on the first Monday in July, and the tuition revenue is to be expended in the school year. No teacher to be employed or to commence school unless licensed by State or county authority.

Text books are prescribed by county board; formerly were not to be changed for three years after adoption. By a law of 1879 may not be changed till the end of the time for which they were adopted, and then new adoptions must be for 10 years.

Township institutes to be held one Saturday in each month, county institutes in each county annually.

The school term is 60 days; month, 20 days; week, 5 days.

Schools to be taught in the English language. German may be taught on request of parents of 25 children.

Township trustees may organize separate schools for colored children, having same rights, privileges, and advantages as the other schools. If no separate schools are provided, they are to be admitted to other schools. Any colored child sufficiently advanced is entitled to enter the higher grade provided for white children. There is to be no distinction in same on account of race or color.

In cities of 30,000 or more, each district is to elect one commissioner to be a member of the board of city school commissioners. The common council is to divide city into districts. City board to organize and elect president, secretary, and treasurer. One-third of board to be elected each year for term of three years. The board to have full charge and control of schools in city. Cities of less than 30,000 may adopt this system.

IOWA.

The constitution requires that a system of common schools shall be provided for, under which a school shall be kept up and supported in each district for at least three months in every year.

The State superintendent is elected for two years by the people, and is charged with general supervision of schools and county superintendents.

County superintendents are elected by people for two years.

In addition to usual duties, they are to report to the superintendent of college for blind names, age, and residence of all persons blind to such an extent as to be unable to acquire an education in the common schools, and also of deaf and dumb in same condition to the superintendent of the institution for deaf and dumb.

Each civil township and each independent district organized prior to the act is declared to be a school district with corporate powers.

Each district township to hold annual meeting on the second Monday in March. In townships comprising one district three directors are to be elected. When divided into subdistricts, one director is elected for each and one at large, who are to constitute the township board of school directors. The township board may divide town into subdistricts. Subdistrict meetings for choice of directors are held the first Monday in March annually. No subdistrict for less than 15 pupils is to be created. Women are eligible to school offices.

Township boards are invested with charge and control of schools and school-houses, but cannot change text books oftener than once in three years except by vote of electors.

In each subdistrict shall be taught one or more schools for the instruction of all youth between 5 and 21 for at least 24 weeks, of 5 days each, every year. Any person who was in the military service of the United States during his minority may be admitted.

Contracts with teachers to be in writing. No person to be employed unless holding certificate of county superintendent.

School month of 4 weeks of 5 days each. Schools to be closed during sessions of institute and teachers required to attend. By vote at any legal meeting, electors may direct German language to be taught.

The county supervisors are to levy a county tax for support of schools of not less than one nor more than three mills on the dollar; also the district tax which may be voted; the district tax for school-house fund not to exceed ten mills; contingent fund not to exceed $5 per pupil; teachers' fund, including semiannual apportionment, not to exceed $15 for each pupil residing in the district. May levy $75 for contingent fund and $270, including semiannual apportionment, for teachers' fund each year for each subdistrict.

The county auditor is to apportion semiannually to the several districts the county school tax and interest on permanent school fund in

proportion to number of persons between 5 and 21, and county treasurer to pay to district treasurer quarterly.

Cities or towns of not less than 300 inhabitants may be constituted independent districts. Independent districts of less than 500 to elect 3 directors—of 500 and over, 6 directors—one-third each year, with powers of township boards.

Counties with a population of 2,000 may establish high schools, to be controlled and managed by 6 directors chosen at a general election, the county superintendent to be president of board. Tax therefor not to exceed five mills.

County superintendent to visit schools once and subdirector to visit them twice each term; enumeration to be made by subdirector.

The State university is governed by a board of regents, consisting of the governor, State superintendent, president of university, and one person from each congressional district, elected by general assembly. The course of study to commence at points where completed in high schools.

KANSAS.

Article VI of the constitution provides that the legislature shall encourage the promotion of intellectual, moral, scientific, and agricultural improvement, by establishing a uniform system of common schools, and schools of a higher grade, embracing normal, preparatory, collegiate, and university department.

Laws to 1879.

The State board of education consists of the State superintendent, chancellor of State University, president State Agricultural College, and principals of normal schools at Emporia and Leavenworth, who may issue State diplomas and certificates to professional teachers.

A State superintendent is elected biennially, charged with usual duties and to recommend list of approved text books.

County superintendents elected biennially by people to have charge of school interests of the county, to divide county into convenient school districts, and may change and alter the same, but no new district to be formed unless it contains 15 scholars of school age.

Every district is a body corporate, and deemed to be duly organized when district board is elected and qualified. Annual meetings of district to be held in August. All persons who are qualified electors and females over 21 are voters in district. The district board consists of a director, clerk, and treasurer, one to be elected each year.

The district by vote determines sites of school-houses; may raise tax not exceeding 1 per cent. for building purposes and 1 per cent. for teachers' fund; determines time school is to be taught, not to be less than 3 months, and whether by male or female teachers; appropriates money for summer or winter school or both; and may direct sale of lot when not needed for school purposes. Two or more districts may unite to es-

tablish graded schools by major vote, and have powers of district. May vote tax not exceeding 2 mills for a district library, to consist of works of history, biography, science, and travels. The district clerk to make annual report to the annual meeting, which he is to submit and read to the legal voters of the district. The district board are to employ and may dismiss teachers; to visit schools at least once each term; shall require uniform text books to be used in each branch of schools; when adopted, no change to be made for five years, unless upon petition of four-fifths of legal voters of district.

Common English branches to be taught in every school district, with such others as district board may direct.

School month, 4 weeks of 5 days of 6 hours each.

Schools to be at all times equally free and accessible to all children over 5 and under 21 resident in district, subject to such regulations as district board may prescribe. Whenever the public money is not sufficient to support schools for the length of time determined by the district, the district board may assess a tuition fee upon each scholar attending, to meet such deficiency, but not until the entire 1 per cent. for teachers' fund has been assessed.

A normal institute for the instruction of teachers is to be held annually in each county.

The county superintendent and two persons appointed by county commissioners are to constitute a county examining board for examination of teachers.

Cities of over 15,000 inhabitants are denominated cities of the first class, and the schools are controlled by a board of education of three from each ward, elected by voters of ward, one each year. Board may elect a city superintendent and appoint their own examining committee. The whole city is to constitute one district for purposes of taxation, but may be divided into subdistricts by the board. Cities of over 2,000 and not exceeding 15,000, of second class, with board of two from each ward, one elected each year, with similar powers.

KENTUCKY.

The constitution provides for the preservation of the school fund and the distribution of the revenue from it, with any sum raised by tax or otherwise in aid of common schools, and for the election of a superintendent of public instruction to hold office for four years.

The school code, as amended up to 1878, provides for a State board of education, to consist of the State superintendent, secretary of state, attorney general, and two professional teachers elected by them, who are made a body corporate; the State superintendent and two professional teachers to be a standing committee to propose rules and determine text books to be adopted at discretion by trustees. The State board may organize and keep in existence a State teachers' association, but no money is to be paid out of the treasury or common school fund therefor. The State superintendent is charged with the usual duties.

A county commissioner of common schools for each county, with one for the city of Louisville, is to be appointed for a term of two years by the court of claims.

The county commissioner may lay off and abolish districts, examine and pay teachers, suspend or remove same for cause, and have general charge of schools of county; may select uniform series of text books from the list furnished by State board, not to be changed for two years, and the district trustees are bound by the selection when made;[1] and shall hold a teachers' institute in his county annually. Teachers, and all persons holding certificates as such, are required to attend.

Persons applying for examination are to pay $1 to county board, or $3 if to State board. Every person attending institute to pay fee of $2.

The county commissioner, with the consent of the white voters of any district, may condemn school-house, and a per capita tax of not exceeding $2 on each white male over 21 may be levied to rebuild the same. Where such amount is inadequate, the trustee may warn in the hands liable to work on the highways for the purpose of rebuilding. The house may be built of logs, stone, brick, or plank, but must be of sufficient size to accommodate the children. If a fireplace is used, the chimney must be of stone or brick; if a stove is to be used, the pipe must be so protected as to be secure against liability from fire.

School districts are to remain as constituted until changed as provided by the act. No district to include more than 100 white children between 5 and 20 years of age, unless it contains a town or village or there be established a high school, academy, or college entitled to a share of the State fund, and none with less than 40 such children.

Cities and towns establishing and maintaining schools adequate for all white children in it shall be deemed one district.

Each district is a body corporate, and its affairs are managed by three trustees, one to be elected annually. Aside from the usual duties, they are charged to invite and encourage all white scholars to attend the schools, to instruct parents that it is their right for which the State pays, even though they may contribute nothing; and their annual report must show that they have performed this duty. They must not make any arrangement for the benefit of some individuals to the exclusion of others. They are to take a census of *white* children between 6 and 20 in April of each year.

Colleges and educational institutions exclusively devoted to the education of white children may be made school districts and receive State school funds for teaching youth of school age.

Where, by contribution or otherwise, 40 volumes can be procured, the trustee may organize a district library; but no part of school revenues derived from general taxation can be used for the purchase of

[1] In the examination of teachers and choice of text books, the commissioner has the aid of two assistants, selected by himself.

books, maps, or charts for the same. The library to be free to all white pupils of suitable age belonging to the district.

A poll or per capita tax of not more than 50 cents per annum may be levied on each patron of the school for fuel and contingent expenses.

The income of the State fund is distributed pro rata for each white child between 6 and 20.

A majority vote of qualified white voters is required to levy a district tax. Any resident widow or alien taxpayer or person having children of school age may vote. District tax not to exceed 25 cents on $100 in any year, and in graded school districts not to exceed 30 cents. Under a law of April 9, 1878, a tax, after due notice to the district, may be voted for five successive years.

No school to be deemed a common school or entitled to contribution out of the school fund unless the same has actually been kept by qualified teachers for five months, or in districts having minimum number (40) of school children, three months during the school year, and at which every white child between 6 and 20 has had the privilege of attending. The school year begins July 1; school month, 22 days.

Prior to 1874 there was no law providing for the education of colored children. At that time an act was passed providing for a uniform system of common schools for colored children, to be supported exclusively by taxes to be levied upon colored people.

The revenue arising from this source is distributed annually by the State superintendent to the counties, and the county commissioner is responsible for its proper distribution.

The county commissioner is to lay off his county into suitable districts, not to exceed 100 nor less than 20 children of school age, and appoint three colored trustees for each district. The teachers are required to hold certificates the same as for white schools. No colored child is allowed to attend a white school, nor any white child a colored school. No house for colored school can be erected within one mile of a white school, except in cities and towns, and there not within 600 feet. The officers and teachers of colored schools may organize State and county associations. The census of colored children is to be taken in the same manner and at the same time as that of the white children.

The State board is to prescribe the course of study and rules for the government of such schools. The State superintendent is to furnish blanks, and is authorized to employ an additional clerk at $700 per annum, paid out of fund collected. Five per cent. of the tax is deducted for collection. The county commissioner is allowed 1 per cent for disbursing, and $3 for each colored school visited are also to be paid out of colored fund. The fund is thus subject to large reduction.

LOUISIANA.

The constitution of 1868 required the establishment of at least one free public school in every parish, free to all children of the State be-

tween 6 and 21, without distinction of race, color, or previous condition. It forbade the establishment of any separate schools or institutions of learning by the State exclusively for any race, and provided that institutions for the education of the deaf and dumb should be fostered by the State.

The new constitution of 1879 requires schools to be established for the education of all children between 6 and 18, to be under the control and direction of parish boards of directors. Each parish board is authorized to appoint a superintendent of its schools, who shall be secretary of the board; the entire system to be under the supervision of a State superintendent chosen for four years.

It requires the general assembly to provide for the support of schools by taxation or otherwise, but at the same time provides that the State tax for all purposes shall not exceed 6 mills. A poll tax is to be levied of from $1 to $1.50 on every male over 21. Four per cent. interest on the full school fund of $1,130,867.50 is to be paid annually to the several parishes for the support of schools, but this interest is to be paid out of the tax to be levied and collected for the general purposes of education. Schools are to be taught in the English language, but in parishes where the French predominates they may also be taught in that language. Women over 21 are made eligible to office under the school laws.

The school law of 1877 provides for a State board of education, to consist of the governor, lieutenant governor, secretary of state, attorney general, State superintendent, and two citizens. They are to prescribe text books and apparatus, not to be changed oftener than once in four years, contract for same with lowest bidder, to be furnished pupils at lowest prices; also, to appoint a board of directors of not less than 5 nor more than 9 for each parish except New Orleans for terms of four years, and fix the branches to be taught in public schools.

The State superintendent is charged with the usual duties.

The parish board appoint from their own number an examining committee, and no teacher can be employed without their certificate. They are required to limit the annual expense of the schools to the revenue derived from the State, parish, or from contributions. They are to divide the parish into subdistricts, provide school-houses, employ teachers, and have control and supervision of schools. Annual and monthly visiting committees are to be appointed by the board, and each school is to be visited monthly.

The public schools of New Orleans are under the control of a board of 20 directors, 8 appointed by the State board and 12 by the city board of administrators. The city board appoint a superintendent for a term of four years, who is ex officio a member of the board, but without vote. They may establish night schools and two or more normal schools.

City and parish boards are to establish schools; no school to be of less than 10 pupils, and not over 60 pupils to be in charge of one teacher. The State board prescribe branches to be taught.

The directors may levy a parish tax of not exceeding 2 mills, but parish tax not to exceed 1 per cent. for all purposes. May levy tax in New Orleans of 2 mills, but not to exceed $275,000.

Enumeration of children of school age to be taken biennially in each district.

The new constitution apparently omits some important requirements of the old, and leaves them in the discretion of the parish board. Until they shall take action in the premises, it cannot be known what changes will be made, nor what effect they may have upon the present system.

MAINE.

The constitution makes it the duty of the legislature to require the several towns to make suitable provision for the support of schools, and from time to time, as circumstances may authorize, to encourage and suitably endow academies, colleges, and seminaries of learning.

School laws as in force, 1878.

The officers of the school system are a State superintendent, appointed by the governor and council, town superintending committees, or town supervisor with same powers, and district agents.

The term of office of State superintendent is three years, and he has general supervision over all public schools of the State. The towns at their annual meeting are to choose a superintending committee of 3, one to be elected each year to serve 3 years.

The town may determine number and limit of school districts, or abolish the same, and assume control of all schools within its limits; may choose agents for districts, or authorize districts to choose them, and may authorize agents to employ teachers instead of superintending committee.

When the town has abolished the district system, the superintending committee have control and management of schools; where divided into districts, the general supervision of same.

Towns are required to raise not less than 80 cents for each inhabitant, exclusive of income of corporate school fund, State moneys, &c., under penalty of forfeiture of not less than twice nor more than four times the amount; and may make provision for free industrial or mechanical drawing in day or evening schools.

They may also raise money to purchase text books for pupils or sell them to pupils at cost.

School districts that have exercised privileges and franchises for one year to be deemed legally organized; all districts, corporations; qualified voters of town resident in district, voters therein.

Annual meetings to be held to choose moderator, clerk, and agent, unless agent is chosen by town.

The district by vote at its legal meetings controls all its affairs; but if it refuse to keep up the school for the required time or to provide

the colored people of any county or in Baltimore also to be devoted to the support of colored schools.

The State tax for school purposes is 10 cents on each $100, no money to be apportioned to any county unless the schools are kept open at least seven and one-half months in the year.

MASSACHUSETTS.

The constitution declares that "wisdom and knowledge, as well as virtue, diffused generally among the body of the people, being necessary for the preservation of their rights and liberties; and as these depend on spreading the opportunities and advantages of education in the various parts of the country, and among the different orders of the people, it shall be the duty of legislatures and magistrates, in all future periods of this Commonwealth, to cherish the interests of literature and the sciences, and all seminaries of them; especially the university at Cambridge, public schools, and grammar schools in the towns."

It further ordains that all moneys appropriated by the State or raised by taxation in the towns and cities for the support of public schools shall be applied to and expended in no other schools than those conducted according to law, and under the order and superintendence of the authorities of the town or city in which the money is to be expended, and never appropriated to any religious sect for the maintenance exclusively of its own school.

Another amendment precludes from voting and from eligibility to office all who cannot read the constitution in the English language and write their names, unless from physical disability, but not taking away their existing right to vote.

School laws as amended to 1878.

The board of education consists of the governor, lieutenant governor, and eight persons appointed by the governor and council for the term of 8 years, one retiring each year in the order of appointment. It appoints a secretary, who is the executive officer of the board, substantially performing the duties of a State superintendent. It may also appoint agents to visit the towns, inquire into condition of schools, and confer with committees or teachers, and generally perform same duties as the secretary might do if present. It prescribes the form of school registers to be kept in the schools, the forms of blanks and inquiries for returns of school committees, has general supervision of school matters, and reports each year to the legislature. The State board also has charge of State normal schools. The other officers are the town school committee, to consist of any number divisible by 3—one-third to be elected by ballot each year for the term of 3 years, at the annual town meeting—who are to have general charge and superintendence of all public schools in the town. No person is ineligible on account of sex.

The school district system has been generally abolished in the State,

out is retained in a few of the towns, and the schools are substantially carried on under the town system.

Every town is required to maintain at the expense of said town, for at least six months each year, a sufficient number of schools for the instruction of all children who may legally attend public school therein, under a teacher or teachers of competent ability and good morals.

The branches to be taught are orthography, reading, writing, English grammar, geography, arithmetic, drawing, history of the United States, and good behavior, to which the school committee may add, in such schools as they deem expedient, algebra, vocal music, agriculture, physiology, and hygiene.

Any city or town may, and every city or town having over 10,000 inhabitants must, annually make provision for giving free instruction in industrial or mechanical drawing to persons over 15 in day or evening schools, under the direction of the school committee.

Every town may, and every town of 500 families or householders must, besides the schools heretofore prescribed, maintain a school to be kept by a master of competent ability and good morals, who, in addition to the branches before mentioned, shall give instruction in bookkeeping, general history, surveying, geometry, natural philosophy, chemistry, botany, civil polity, and the Latin language; such school to be kept for the benefit of the whole town 36 weeks at least in each year, exclusive of vacations, and in every town of 4,000 inhabitants the teachers of such school shall be competent to instruct in astronomy, geology, rhetoric, logic, intellectual and moral science, political economy, and in the Greek and French languages.

Cities and towns may establish industrial schools to be under the control of the school committee, but attendance on such schools is not to take the place of attendance upon the public schools required by law.

One or more female assistants are to be employed in every school having an average of 50 or more scholars, unless the town by vote dispense with such assistants.

Towns neglecting to raise money for the support of the schools required by law shall forfeit a sum equal to twice the highest sum ever before voted for schools therein. Towns neglecting to choose school committee forfeit not less than $500 nor more than $1,000, forfeitures to be paid into county treasury, and three-fourths of same to be turned over to school committee, if any, or to selectmen, and used for support of schools in same manner as if raised by tax.

The school committee are to supervise schools, direct what books are to be used, prescribe as far as practicable the course of study and exercises to be pursued, procure at expense of town sufficient supply of text books to be furnished to pupils at cost; may procure at expense of town such apparatus, books of reference, and other means of illustration as they may deem necessary in accordance with appropriations made therefor. Cities or towns may authorize committee to purchase

text books for use in schools, to be the property of the city or town, and to be loaned to pupils under such regulations as they may prescribe.

Any city or town may require committee to appoint a superintendent who, under their direction, shall have care and superintendence of the schools.

Towns not divided into districts to provide and maintain a sufficient number of school-houses for the accommodation of all children therein entitled to attend.

School census to be taken in May each year of all children between 5 and 15. No person excluded from schools on account of race, color, or religious opinions of applicant or scholar.

There are compulsory requirements as to sending to school children from 8 to 14 years of age, and through the aid of truant officers in towns these laws have been made remarkably effective, the enrolment in the schools for several years past having considerably exceeded the number of children of school age.

MICHIGAN.

The constitution requires the legislature to provide for and establish a system of primary schools to be kept without charge for tuition at least three months each year in every district.

It also provides for a superintendent of public instruction and a State board of education, of three members, one to be elected at each biennial election for the term of six years. The State superintendent is ex officio a member and secretary of board, which has especial supervision of the State normal school. The constitution further directs the legislature to provide for township libraries, and applies for the support thereof all fines for breach of the penal laws of the State.

The State superintendent is elected biennially, and charged with general supervision of public instruction: to visit and report upon the State university, all incorporated literary institutions, primary and normal schools, and State reform school; to prepare list of books best adapted to use of schools and for township libraries.

There is no county organization under the present law, the office of county superintendent having been abolished in 1875.

At the annual meeting of each township in April are to be elected a school inspector and school superintendent, who, with the township clerk, are to constitute the township board. The superintendent is chairman of board, is to examine teachers, visit schools at least twice each year, is subject to rules and regulations of State superintendent and to report to him. Each organized township to maintain a library, which may be divided into district libraries.

The township board is to divide township into convenient districts, and may alter and regulate boundaries. No district to be divided and no two districts consolidated without vote of a majority of taxpayers.

Every person over 21 who has been a resident for three months and

holds property liable to tax, is a voter. All persons entitled to vote at township meetings who have resided in district three months are eligible to office and may vote on all questions, except when raising of tax is in question. School districts are deemed to be organized when any two of the three officers have filed acceptance of office.

The district by vote provides school-houses, imposes taxes, determines length of schools, whether to be taught by male or female teachers, and provides for repairs, purchase of apparatus, libraries, and for payment of debts and liabilities.

The tax for building purposes in any one year is limited to $250 in districts containing less than ten children of school age, to $500 in districts of over ten and less than thirty, and to $1,000 unless over fifty. Schools must be maintained not less than nine months in districts of 800 children of school age, five months in districts of from 30 to 800, and three months in districts of less than 30. In districts of less than 30 children of school age amount raised for entire support of schools, including share of school fund and two mill tax, not to exceed $50 per month. If district refuses or neglects duties, town board are to perform same. The director, or such person as the board may appoint, is to take census of children between 5 and 21. District board to employ qualified teachers.

The school year commences on the 1st Monday of September in each year; school month, 4 weeks of 5 days each.

Town boards to adopt text books not to be changed for 5 years; no money to be paid to towns until books so adopted are used, and proportion of 2 mill tax forfeited if schools not maintained as provided by law.

All residents of a district five years of age have equal right to attend any school therein, and no separate school or department to be kept for any race or color. This provision not to prevent grading of schools.

Graded schools may be established in districts of more than 100 children by two-thirds vote, to be controlled by board of trustees, one-third to be elected each year, with powers of district board. By act of April 17, 1871, a State public school for dependent and neglected children was established and placed under supervision of a board of control of eight persons appointed by the governor, one to be appointed every two years.

Its object is to receive children over 4 and under 16 years of age who are in a suitable condition of mind and body to receive instruction and who are neglected and dependent, especially those maintained in county poorhouses or who are abandoned by parents, orphans, or whose parents have been convicted of crime.

Such children are to be maintained and educated in the branches taught in the common schools, and to have proper physical and moral training. The declared object is to provide temporary homes until homes can be found in families. It is the duty of the board of control

to provide suitable places for them when sufficiently educated, and it is made the legal guardian of such children and may bind them out.

Whenever there is a vacancy in such school the superintendents of the poor are to bring the children in the poorhouses, or other children in want or suffering, or abandoned or improperly exposed, or in any orphan asylum whose officers desire to surrender them, for examination before the judge of probate, who is to determine the facts as to dependency. The superintendents of poor are to forward children to such school.

MINNESOTA.

Article VIII of the constitution recites that, "the stability of a republican form of government depending mainly on the intelligence of the people, it shall be the duty of the legislature to establish a general and uniform system of public schools;" and it requires that "the legislature shall make such provisions by taxation or otherwise as, with the income arising from the school fund, will secure a thorough and uniform system of public schools in each township of the State."

Laws to 1877.

The State superintendent is appointed by the governor, with consent of senate, for 2 years, charged with usual duties.

A county superintendent is elected for each county for 2 years, who is to examine teachers and have general supervision of schools of his county. In counties containing over 100 districts he may appoint an assistant.

The district system has been adopted in this State. Every district is presumed to be legally organized after it shall have exercised the privileges and franchises for one year. Districts are classified as follows: First, common school districts; second, independent districts; and, third, special districts. The county commissioners may form new districts.

Legal voters of district are to choose moderator, director, clerk, and treasurer; the director, treasurer, and clerk to constitute the district board. Women may vote in district meetings.

The district to provide houses and grounds, establish schools, and raise money by tax. Tax for building purposes not to exceed 8 mills in any one year, but may raise $600 if it does not exceed 25 mills. Districts of less than ten voters may raise $200 only.

District board may levy tax if district neglects, hire teachers, and have charge of schools.

Independent districts to be under the control of six directors, two elected each year; to keep schools in operation not less than 12 nor more than 44 weeks each year; to appoint board of examiners, who are to examine teachers and visit and examine schools in such districts.

All schools supported wholly or in part by the State school fund to be deemed public schools, and admission to the same shall be free to all persons between 5 and 21 residing in the district; none to be excluded on account of color, nationality, or social position.

School month, 4 weeks of 5 days each.

A county tax of 1 mill, all fines for breach of penal laws, and amount of liquor licenses to be county school fund.

The State contracts for text books; the counties to pay for amount ordered by them at the prices fixed. Books so procured are to be used in schools and not changed for five years; $50,000 set apart as a text book fund for this purpose.

The State normal schools are under control of board of 6 directors, 3 appointed every 2 years by governor and senate; supported by State appropriations; tuition free to State pupils who engage to teach for two years.

MISSISSIPPI.

The earlier constitutions contained the declaration that, "religion, morality, and knowledge being essential to good government, the preservation of liberty, and the happiness of mankind, schools and the means of education shall forever be encouraged."

Article VIII of the constitution of 1868 required the legislature to establish a uniform system of free public schools for all children between the ages of 5 and 21, and as soon as practicable schools of a higher grade, one or more schools to be maintained in each school district at least four months in every year. It also provided for a State board, State superintendent, county superintendent, and for the establishment of a common school fund; and in addition thereto the legislature was authorized to levy a poll tax not exceeding $2 and provide for the levy of such other taxes as should be required to properly support the school system, all school funds to be divided pro rata among children of school age.

School laws to 1878.

The State board have the management and investment of the school fund, and are to report its state and condition each year. The State superintendent is elected every four years, has general charge and superintendence of school system, and is to determine true intent and meaning of school laws, rules, and regulations, his decision to be final unless reversed by State board.

The county superintendent is appointed by the State board for two years, has supervision of schools in county; he is to arrange the schools of his county so that suitable school facilities shall be afforded to every child of school age, to examine teachers, and open and close schools so that equal number of days shall be given to all schools in the county.

The patrons of the school are to elect 3 trustees to manage district

affairs. In incorporated towns the mayor and aldermen are to appoint trustees.

Every county constitutes a school district. Towns of 1,000 may constitute an independent district.

County superintendents are to procure certificates of qualification from the county board of examiners, consisting of 3; one appointed by county supervisors, one by chancellor of district, and one by the judge of the circuit court.

Ample free school facilities are to be furnished to all of school age, but white and colored are to have separate houses. Schools to be taught five months in each year, but the time may be reduced to four months when the aggregate tax would exceed $7.50 on the $1,000.

Private high schools may educate State students and receive $2 monthly from the school fund for each one's tuition.

School year commences January 1. The school month is 20 days of not less than 6 nor more than 8 hours each.

The county assessor takes census of school children.

The pay of teachers is regulated by statute and based upon the average attendance. In schools of first grade, where the average attendance is 25, the pay is 8 cents per scholar; in the second grade, 6 cents, and in the third grade, 5 cents. If the average attendance is over 12 and less than 25, the pay is the same for number actually attending, and one-third of above rates for the difference between number actually attending and 25. But the total amount paid out of school fund shall not exceed 7½ cents for principal and assistants.

The above rates may be increased one-tenth or diminished one-tenth in cities and towns constituting separate school districts.

The State school fund not to be less than $200,000 each year. The county tax not to exceed 3 mills.

In the city of Columbus the mayor and aldermen are made school trustees, and, with the county superintendent, constitute the city board and control city schools.

Text books, not to be changed for 5 years, are to be selected by the teachers of county, in convention.

MISSOURI.

Constitution, Article XI: "A general diffusion of knowledge and intelligence being essential to the preservation of the rights and liberties of the people, the general assembly shall establish and maintain free public schools for the gratuitous instruction of all persons in this State between the ages of 6 and 20 years."

If the public school fund provided and set apart for the support of free public schools should be insufficient to sustain schools at least four months in each district, the general assembly are to provide for the deficiency. In no case shall there be set apart less than 25 per cent. of

the State revenue, exclusive of the interest and sinking fund, to be applied annually to the support of schools.

It further provides for a State superintendent and a State board, consisting of the governor, secretary of state, attorney general, and State superintendent, the latter to be president of board.

Code of 1874.

The State superintendent is elected for four years and charged with usual duties.

The county commissioner is elected for two years.

The county courts have management and care of township and county school funds, and annually apportion moneys to districts according to enumeration of children of school age.

Subdistricts, as now organized and bounded, are continued as school districts.

The control is vested in 3 directors chosen by the qualified voters for terms of 3 years, one elected each year, who are to meet and organize within five days after election. They have the general powers of district boards, and are to take annual enumeration of children between 5 and 21.

Teachers are to hold certificates from State superintendent or county commissioner, and are required to attend institutes.

Cities, towns, and villages may be organized into school districts, under control of six directors. After first election, one-third to be elected each year, to constitute the board of education.

Central schools may be established, to be under control of a board consisting of the presidents of district boards. Two or more districts by majority vote may unite for this purpose and form a central school district.

The presidents of boards of cities, towns, and villages, and directors of districts, to meet in convention every five years and adopt text books.

The annual rate of tax in districts for school purposes not to exceed 40 cents on $100, but may be increased by a majority vote to 65 cents, and in districts formed of cities and towns to $1. The school year commences on the first Tuesday of April. School month, 4 weeks of 5 days; school day, 6 hours. The income of State, county, and town funds to be used for teachers' wages.

Where the number of colored children in any district exceeds 15, schools are to be established for them. The tax for the maintenance of any colored school shall be levied and collected from the taxable property of the township in which such school is located. Two or more districts may be united to maintain a colored school where each has less than minimum number. The State superintendent is to provide for the same if the local board neglect.

NEBRASKA.

Article VIII of the constitution requires the legislature to provide for the free instruction in the common schools of all persons between

less than $350 for each $1 of the State apportionment—to be assigned to districts according to valuation or in such other mode as town may determine.

Towns may divide into districts or they may abolish districts. Districts composed of the whole town must elect and any other district in any town in which there are 50 children may elect a board of education of 3, 6, or 9, one-third to retire each year. High school districts may be established by a two-thirds vote of the town or of any district of 100 scholars, and two or more districts may, by concurrent votes, unite to support a high school or other schools.

When town is divided into districts each district is to elect a prudential committee, who is the executive officer of the district and employs teachers holding certificates of town committee.

The districts have the usual powers under the district systems. Women are voters and eligible to school offices.

Town committee determine text books, are to visit schools at least twice each term, and are to report to the town at its annual meeting, and also to the State superintendent.

NEW JERSEY.

The constitution requires the legislature to provide for the maintenance of a thorough and efficient system of free public schools for the instruction of all children in the State between the ages of 5 and 18.

School laws, 1879.

The general supervision and control of public instruction is vested in a State board of education, consisting of the trustees of the State school fund and of the State normal school. The trustees of the school fund are the governor, president of the senate, speaker of the house, attorney general, secretary of state, and controller. The trustees of the normal school are two from each congressional district, appointed by the governor, with consent of the senate, one in each district appointed each year for the term of two years.

The State superintendent is appointed by the State board for a term of two years. He is to carry out the instructions of the board; is ex officio a member of the normal school board, and with principal of normal school constitutes State board of examiners.

County superintendents are appointed by State board, subject to approval of chosen freeholders, and hold during pleasure of board.

Each school district elects 3 trustees, to serve 3 years, one to be elected each year, with usual powers of district boards. Females are eligible.

The district trustees constitute the township association; the county and city superintendents form a State association, of which the State superintendent is president.

The county superintendent and 3 teachers appointed by him are a county board of examiners. In cities governed by special law, the city board appoint examiners and a city superintendent.

The county superintendent is to fix boundaries of districts, and may divide or unite the same, but no new district is to be formed unless it contains 75 children of school age. Each incórporated city or town forms one district.

Any two or more districts may unite to establish graded schools, to be governed by joint board and entitled to share of school fund.

Every district to provide its own school-houses, and forfeits right to any share of school appropriation unless nine months' school is maintained.

The State school tax is two mills; $100,000 from income of school fund to be paid to the counties in two or more instalments; $100 for each county, for teachers' institutes. If the State fund is insufficient for a nine months' school, a township tax may be levied.

The legal voters of district may levy a tax. All moneys received by district, other than district tax, over $20, to be used for teachers' salaries.

Tuition free to all residents of district between 5 and 18, and all from 8 to 14 years of age are required to attend school at least 12 weeks each year. Corporal punishment in schools is prohibited.

Districts raising $20 for a library are entitled to same amount from the State.

An act of March 14, 1879, provides that districts theretofore receiving $350 shall thereafter receive but $300 from State apportionment.

Every county is entitled to send to State normal school, free of charge for tuition, 3 pupils for each representative elected.

Applicants for admission to State agricultural college are to be selected by the county superintendent on examination.

NEW YORK.

By the constitution, the capital of the common school fund, of the literature fund, and of United States deposit fund is to be preserved inviolate; $25,000 of the revenues of the deposit fund are to be annually added to capital of common school fund; the revenues of the literature fund are to be applied to support of academies; the revenues of common school fund, to support of common schools.

School laws, 1878.

A State superintendent is elected by joint ballot of senate and house for three years. He is ex officio trustee of Cornell University, a regent of the State university, general supervisor of State normal schools, and trustee of State Asylum for Idiots; provides for education of Indian children, and visits institutions for deaf and dumb and blind, with usual powers and duties in reference to common schools, and may appoint a deputy.

The State is divided into districts, having no special reference to county or township lines, in each of which is to be elected triennially a school commissioner, with the ordinary powers and duties of a county commissioner in his district, and is to define the boundaries of school

districts in his jurisdiction, divide territories into districts when necessary, and, with consent of trustees, may alter the same.

School districts are at annual meetings to elect one or three trustees clerk, tax collector, and librarian. Where there are three trustees, one is to be elected each year. District officers must be qualified voters.

Every resident male of 21 years of age who owns or hires real property liable to school tax; every resident authorized to vote at town meetings, having a child of school age who has attended eight weeks the preceding year; owner of personal property exceeding $50 in value, exclusive of such as is exempt from execution, liable to school tax, and no others, are qualified voters in district meetings.

The district, by vote, may designate sites, levy tax to build, purchase or repair houses, and to raise money for district purposes, not to exceed $25, for purchase of maps, apparatus, &c., and not to exceed same amount for anticipated deficiency in contingencies, and the taxable inhabitants may vote annual tax of $50 for library.

The trustees have usual powers of district board, and are to report number of children in district between 5 and 21.

The common schools are to be free to all over 5 and under 21 resident in district; and children between 8 and 14 years old are required to be sent to some school at least 14 weeks in each year, but no Indian children may be admitted to the public schools in districts where a separate school is provided for them.

Teachers must hold diploma from State normal school, or certificate of State superintendent, school commissioner, or the proper school officer of city or village.

Union free schools may be formed, to be controlled by not less than 3 nor more than 9 trustees, one-third elected each year, who are to constitute board of education. Such union district to be recognized as a school district in distribution of school moneys. The board has power of trustees; may grade schools.

District school authorities may, if they deem it expedient, establish separate schools for colored children, to be supported in same manner and to same extent as other schools.

Boards of education or school districts, by two-thirds vote, to designate text books, not to be changed for five years.

An act of May 13, 1878, requires the trustees to be elected by ballot in all districts of over 300 children of school age.

NORTH CAROLINA.

The constitution requires the legislature to "provide by taxation or otherwise for a general and uniform system of public schools, wherein tuition shall be free of charge to all children between 6 and 21 years of age." White and colored are to be in separate schools, but no discrimination to be made in favor or to the prejudice of either race.

It also provides for a State superintendent and a State board of edu-

cation, to consist of the governor, lieutenant governor, secretary of state, treasurer, auditor, attorney general, and State superintendent.

It provides that each county shall be divided into school districts, and that a school shall be maintained in each district at least four months each year, and makes any county commissioner failing to comply with this requirement liable to indictment. It provides for an irreducible educational fund, makes the University of North Carolina a State institution, and directs that its benefits shall, as far as practicable, be extended to the youth of the State free of charge for tuition. It gives the State board full power to legislate and make all needful rules in relation to the free public schools and the educational fund of the State, subject to amendment or repeal by the legislature, and empowers the legislature to enact that every child of sufficient mental and physical ability shall attend the public schools during the period between 6 and 18 not less than 16 months, unless educated by other means.

Laws in force, 1877.

The county commissioners of each county constitute the county board of education. They are to appoint one resident examiner to examine teachers; lay off county into districts; employ teachers; if money insufficient for 4 months' school, may levy tax for deficiency; and appoint school committee of three for each district.

Every school to which aid shall be given from State shall be deemed a public school, to which children between 6 and 21 only shall be admitted. Moneys are to be apportioned to the districts according to the number of children between 6 and 21. Teachers are to hold certificates, which are of three grades. Teachers of the first grade are not to be paid over $2 a day; teachers of the second grade, not to exceed $1.50; and of the third grade, not to exceed $1. No teacher to be paid for less than one month of twenty days.

Course of study and text books are prescribed by the State board. School committees take an annual school census of their districts.

Laws of 1876–'77 provide for normal instruction of both white and colored teachers, and authorize townships having within their limits cities of 5,000 or more inhabitants to levy taxes for the support of graded public schools.

OHIO.

The constitution contains the usual requirement that a thorough and efficient system of common schools shall be provided for by taxation or otherwise.

The law is taken from the last compilation of the State commissioner, 1879. The State commissioner is elected triennially, and is to appoint a State board of examiners.

A county board of examiners of three is appointed in each county by

the probate judge, who hold for two years; city boards of examiners, by the city boards of education.

School districts are classified as city districts of first class, city districts of second class, village districts, and township districts.

Cities of 10,000 or more inhabitants are of first class, and under control of a board of education of one or two from each ward, elected by voters. Cities of less than 10,000 are of second class, and with incorporated villages are controlled by a board of three or six, elected by voters.

Each township constitutes one district and is under control of a board consisting of the township clerk and the clerks of the subdistrict boards. The township clerk is clerk of board, but without vote.

Townships are divided into subdistricts. The qualified voters of each subdistrict elect a board of three directors; one elected each year, to serve three years. The directors elect one of their number clerk, and manage the district affairs under direction of township board, employ qualified teachers, and take census of children between 5 and 21.

The township board control central or high schools when established; may grade subdistrict schools, assign scholars to primary schools, and regulate admission to graded schools. They may appoint an acting manager and establish one or more separate schools in each district for colored children when the number exceeds 20, but if the number is too small for a separate school they may be admitted to other schools. They may exclude children under six in cities or towns of 1,000 or more inhabitants.

Township and city boards prescribe the studies to be pursued and the text books to be used.

The State school fund is to be used for payment of teachers, but no teacher is entitled to pay until reports are made; no township is entitled to apportionment unless at least 24 weeks' school has been kept up, and no district, unless an enumeration of its youth has been taken and returned.

Cities of less than 40,000 may levy a school tax of 4 mills; of 40,000 and less than 100,000, 3 mills; of 100,000 or more, 2 mills; and are to maintain schools not less than 24 nor more than 44 weeks each year.

The school month is 4 weeks of 5 days each. Upon demand of 75 voters, German is to be taught. The schools are to be free to all children resident in district between 6 and 21 years of age, and persons having children between 8 and 14 years of age are required to send them to a common school at least 12 weeks in each year, unless otherwise instructed or excused by the school board. Without such schooling no child under 14 may be employed for labor during school hours.

City and county teachers' institutes are provided for, and during the session of the former all teachers of common schools within the county may dismiss their schools to attend the institute. City boards may also allow their teachers to attend.

OREGON.

The constitution requires the establishment of "a regular and uniform system of common schools," and that the income of the school fund shall be distributed to the districts according to the number of children therein between the ages of 4 and 20 years, to be applied to the support of the common schools and the purchase of suitable libraries and apparatus.

School laws, 1878.

The State superintendent is elected by the people for four years, with usual powers and duties.

The governor, secretary of state, and State superintendent constitute the State board, who are to prescribe rules for the general government of schools, to secure regularity of attendance, prevent truancy, and promote the interests of the schools, to sit as State board of examiners and grant State diplomas and certificates.

A county superintendent is elected by people for two years, who has supervision of schools in county; is to lay off county into districts and change or alter same and examine teachers.

Organized districts are to hold their annual meeting in March and choose a clerk and three directors, one director to be elected each year for 3 years.

The directors are to provide school-houses, take care of and furnish the same, when instructed by major vote of district; employ teachers, and maintain high school six months in districts where the number of school children is 1,000 or more.

Any citizen who has resided in the district 30 days next preceding the meeting may vote. Widows having children of school age and taxable property may also vote.

The schools are to be free to all persons resident in district between 6 and 21. A school quarter is 12 weeks or 60 days, and no district may receive its portion of the school fund unless it reports, by the first Monday of March, that it has had a school of that duration.

Text books determined by State board on vote of majority of county superintendents.

Institutions for deaf and dumb and blind are provided for under control of State board.

Enumeration of children between 4 and 21 taken by district clerk.

PENNSYLVANIA.

The constitution requires "the support and maintenance of a thorough and efficient system of common schools, wherein all the children of this Commonwealth above the age of six years may be educated," and an appropriation of at least one million dollars each year for that purpose. Women 21 years of age and upwards are eligible to office under the school laws. Appropriations to sectarian schools are forbidden.

Laws as compiled by State superintendent.

The State superintendent is appointed by the governor for term of four years, with usual powers and duties.

County superintendents are elected triennially by viva voce vote in convention of district directors.

Cities and boroughs of over 7,000 inhabitants may have their own superintendent, to be elected for 3 years by school directors of same.

Every township, borough, or city constitutes a school district. In every city or borough which consists of more than one ward, each ward is a school district. Independent districts may be formed and abolished by the court of quarter sessions.

School districts are bodies corporate, and may purchase and hold real and personal estate necessary for the support and establishment of schools, and sell and dispose of the same when not needed for such purpose.

Each district is to elect six directors, one-third to be elected each year for three years. The directors are to organize and choose a clerk[1] and treasurer.

The board exercise general supervision over the schools; appoint all teachers and fix their compensation. They shall establish a sufficient number of schools for the education of all persons between 6 and 21 in their districts who may apply for admission. The number, location, size, and arrangement of school-houses are in their discretion. They shall direct what branches are to be taught and the books to be used—books not to be changed oftener than once in five years.

They may grade schools and prescribe qualifications of admission thereto; establish separate schools for colored children whenever they can be located so as to accommodate 20 or more scholars.[2]

The school month is 22 days. Less than 110 days of school will not entitle a district to share of State moneys.

The directors determine the amount of school tax to be levied, which, with amount received from State appropriation and from other sources, must be sufficient to maintain schools for not less than 5 nor more than 10 months each year.

State moneys are apportioned according to the number of taxables in each district.

In cities or boroughs divided into wards the ward directors exercise the powers and duties of school directors as regards the erection and repair of houses and providing lots, and the levy of taxes therefor. All other duties are to be performed by a board of controllers, consisting of the directors of each ward. Whenever the directors of each district shall convey to such board of controllers all district property, the city

[1] In practice, the clerk is the acting superintendent of the schools of the district.

[2] The law seems to require the establishment of separate schools where 20 or more scholars can be accommodated. Where this number cannot be collected into one school there is no law which excludes them from the other public schools.

or borough shall thereafter constitute but one district, the number of directors from each ward not to exceed 3.

RHODE ISLAND.

The constitution declares that, "the diffusion of knowledge, as well as of virtue, among the people being essential to the preservation of their rights and liberties, it shall be the duty of the general assembly to promote public schools, and to adopt all means which they may deem necessary and proper to secure to the people the advantages and opportunities of education."

School laws, 1874.

The State board of education consists of the governor, lieutenant governor, and one member from each county except Providence, which has two, to be elected by the general assembly, two each year.

The board elect annually a State commissioner, who is charged with the usual duties and under direction of State board is to secure uniformity in text books.

Any town may establish and maintain schools with or without forming school districts, and may provide suitable houses in all the districts, but districts which have provided suitable houses are not to be again taxed for such purpose.

Each town is to elect a school committee of not less than 3, one-third to be elected each year for term of three years,[1] and may elect a superintendent of schools; failing to do so, its school committee must appoint one. Districts elect a moderator, clerk, treasurer, collector, and one or three trustees. Joint school districts with 2 trustees are provided for. Voters in town may vote in district of residence; none but taxpayers may vote on question of tax or expenditure of money raised thereby. The powers of districts when formed, or of the towns when not divided, are the usual powers under the New England system. The voters of the district, whether it be a part only or the whole town, control the school affairs. The district trustees are the executive officers of the district, while the town committee have general supervision of schools and, where town is not divided, powers of trustees.

No person can be excluded from any public school in the district of residence on account of race or color, or on account of being over 15 years of age, or otherwise, except by some general regulation applicable to all. Every school aided by the State is to be visited by the town committee, State board, or State commissioner.

If any districts neglect to organize, or for seven months neglect to employ teachers and establish schools, the town committees are to act for them.

Schools in the city of Providence are governed by ordinances of city authorities.

[1] Women are eligible to school committees.

Of the income of the State school fund $90,000 are to be apportioned annually, $63,000 according to the number of children under 15 and $27,000 according to number of districts. This State money goes to teachers only. No town is entitled to any share unless it shall raise an equal amount by tax. When the schools are maintained by organized districts, the town's proportion of the $63,000 is to be divided among the districts, one-half equally and one-half in proportion to average attendance, and its share of the $27,000 equally among the districts.

State assistance towards the formation of town libraries as means of education is authorized by a law of 1875.

SOUTH CAROLINA.

The constitution provides for a State superintendent to be elected as other State officers, also for the election of a commissioner for each county biennially, said commissioners to constitute the State board of education, with the State superintendent as chairman. It also requires the legislature to provide for a liberal and uniform system of free public schools, to provide for the compulsory attendance at some public or private school of all children between 6 and 16, not physically or mentally disabled, for a term equivalent, at least, to 24 months, to levy a tax for support of schools on all taxable property and a per capita tax of $1 on every male over 21. It also provides for the establishment of a State normal school, the education of the deaf and dumb and blind, a State reform school for juvenile offenders, for the organization of an agricultural college in connection with the State university, and, further, that all universities, colleges, or public schools supported, in whole or in part, by the State shall be free and open to all the children and youth of the State without regard to race or color.

School laws, 1878.

The State board is an advisory body to State superintendent, and hears appeals from county boards. The State superintendent and four persons appointed by governor constitute State board of examiners.

The board of examiners prescribe and enforce course of study in public schools and uniform series of text books, not to be changed for five years without permission of the general assembly.

The county commissioner and two persons appointed by State board constitute county board of examiners.

The county board lay off county into convenient school districts and appoint for each school district a board of 3 trustees to serve 2 years, who are to provide houses, employ qualified teachers, and have care of district affairs.

The school year begins November 1. The county board are to limit school terms according to fund. All contracts in excess of funds apportioned are void.

The schoo commissioner of the county of Charleston is to organize and have charge of schools outside of the city.

For the city of Charleston there is a city board, consisting of one from each ward, who are to elect a chairman, clerk, and superintendent, and have charge and control of the city schools.

The State school tax is one mill and the poll tax of $1.

TENNESSEE.

The constitution of 1870 declares it to be "the duty of the general assembly in all future periods of this government to cherish literature and science." It provides for a perpetual school fund, the interest of which is to be applied "to the support and encouragement of common schools throughout the State, and for the equal benefit of all the people thereof;" no part of said fund to be diverted to any other purpose. It further provides that "no school established or aided under this section shall allow white and negro children to be received as scholars together in the same school."

School laws of 1873, *as amended to* 1879.

The State superintendent is appointed by the governor and senate for a term of two years, and charged with the usual duties.[1]

A county superintendent is appointed by the county court biennially, with general supervision of county schools. One of his duties is "to suggest to district directors such changes as may be necessary to secure uniformity in the course of study, when it can be done without expense to parents."

Districts to be constituted as now or as they may hereafter be established.

On the first Thursday in August the qualified voters of each district are to elect a board of three directors for the term of three years, one to be elected each year. If the district fails to elect, the county superintendent to appoint. Directors are to be residents of the district; teachers not eligible. The directors have charge and control of schools in district under supervision of county superintendent.

The schools are to be free to all persons between 6 and 21 resident in the district; white and colored to be separate.

The branches to be taught are orthography, reading, writing, arithmetic, grammar, geography, elementary geology of Tennessee, history of the United States, vocal music, and elementary principles of agriculture. No other branches to be introduced except by local taxation or payment of tuition.

Where the number of scholars is sufficient, preference is to be given to graded schools. The consolidation of public schools with private

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[1]A State board of education for the establishment and care of normal schools was created in 1875, and succeeded in establishing a good normal college at Nashville, but the legislature has failed to render it any pecuniary aid.

stitution, or by reason of danger from hostile Indians or prevalence of contagious or infectious disease. No indication of such requirement appears in the new law.

VERMONT.

The constitution declares that "laws for the encouragement of virtue and the prevention of vice ought to be constantly kept in force and duly executed. And a competent number of schools ought to be maintained in each town for the convenient instruction of youth, and one or more grammar schools be incorporated and properly supported in each county in the State."

School laws of 1874, as subsequently amended.

A superintendent of education is elected biennially by the legislature for the State. Each town also elects a superintendent of common schools, and these superintendents in each county are to meet annually at the county seat, prepare a series of questions for the examination of teachers, fix a standard of qualifications, and choose by ballot one of their number and two practical teachers of the county to constitute an examining board to determine upon a series of text books.

Each organized town is to maintain and support one or more schools under competent teachers, and may establish central or high schools for advanced pupils and elect prudential committee therefor; each pupil from other towns to be charged tuition fee, to be fixed by such committee.

The towns are the primary authority, but may form school districts. When districts are formed they are to elect officers, among which is a prudential committee of one or three; all officers must be legal voters. Voters in town meetings may vote in district of residence.

The powers of the town superintendent and district and prudential committee are the same as in the other New England States.

If the district neglects to comply with the requirements of the laws, the selectmen of the town are to appoint new officers, who are to open and keep up schools at expense of district, and assess tax therefor. A town tax of nine cents on each $1 of the list is to be levied, including one-half the interest on the United States deposit fund. Towns may raise such additional sum as they please. No district entitled to share unless schools are taught two terms of 10 weeks each. School week, 5 days; school month, 4 weeks. Towns may abolish districts and assume control of schools.

VIRGINIA.

The constitution provides for the election by the general assembly of a State superintendent for a term of four years; for a board of education, to consist of the governor, attorney general, and State superintendent; for county superintendents, to be appointed by the State

board, subject to confirmation by the senate, and for division of townships into school districts of not less than 100 inhabitants, and in each district a board of three trustees, with terms so arranged that one shall be elected each year.

It also requires the general assembly to establish a uniform system of free public schools, to be introduced into all the counties of the State; authorizes laws to prevent parents and guardians from allowing their children to grow up in idleness and vagrancy; the establishment of normal and agricultural schools and such grades of schools as may be for the public good. It requires the State board to provide for uniformity of text books and the furnishing of school-houses with the necessary apparatus and a library; makes provision for a State literary fund, the interest of which, with the capitation tax and an annual tax of from 1 to 5 mills, is to be for the equal benefit of all the people of the State, to be divided according to the number of children between 5 and 21.

It requires provision to be made for the supply of text books to pupils whose parents are unable to supply them and authorizes each district to raise additional sums by tax for support of public schools, not to exceed 5 mills in any one year, the general assembly to fix salaries of school officers and make all needful laws to carry these provisions into effect.

School laws, 1878.

The State board is authorized to make by-laws and regulations for carrying into effect the school laws, decide upon appeals from decisions of State superintendent, regulate all matters arising under school system not otherwise provided for, invest school fund, and audit all claims paid out of State fund.

The State superintendent is to determine true intent and meaning of the school laws, see that laws and regulations are faithfully executed, and has general charge and supervision of system.

County superintendents are charged with the usual duties. There is also provision for a county school board composed of the county superintendent and district trustees, to care for county school property. District trustees are to be appointed by joint action of the county superintendent, county judge, and attorney. They are to be residents of the district, elect a president and clerk of their own number, and have charge of district affairs. They are to provide suitable school-houses and appurtenances according to exigencies of the district and means at their disposal, no house to be erected unless with approval of county superintendent. Incorporated towns of 500 to 5,000 inhabitants may constitute school districts, and through their councils appoint boards of school trustees.

No district is entitled to share of school fund until houses are provided, nor unless five months' school has been maintained the current year.

The public schools are to be free to all residents of the district between 5 and 21. White and colored are to be separate, but under the same general regulations as to management, usefulness, and efficiency.

Schools must have an average attendance of not less than 20, to be wholly supported by the State, but the trustees, with consent of county superintendent, may legalize a school where the average attendance is not less than 15. An average of attendance of not less than 10 may be allowed where two-thirds of support is from other than State funds.

The branches taught are limited to orthography, reading, writing, arithmetic, grammar, and geography, unless by special regulation of State board. Preference to be given to graded schools where number is sufficient.

Any district board may admit into any one of the public schools instruction to qualify pupils to become teachers or to enter colleges or the higher institutions of learning, and require therefor a tuition fee not exceeding $2.50 a month.

County and district taxes are not to exceed 10 cents on $100, except in Alexandria County, where 50 cents may be levied by a three-fourths vote.

The number of schools is to be according to the available funds to be distributed by the State board in proportion to number of children between 5 and 21.

Cities of 10,000 or more inhabitants are of the first class; cities of less than 10,000 are of the second class.

Every city is a district, or, if divided into wards, each ward is a district. All the trustees constitute the city board.

The State board to appoint a superintendent for cities of the first class. The city boards are to prescribe the number and size of districts until divided.

The city school tax is not to exceed 3 mills.

WEST VIRGINIA.

Article VII of the constitution provides for a State superintendent, to be elected for four years, for a poll tax of $1, and State tax not to exceed 95 cents on $100. Article XII, for a thorough and efficient system of free schools, to be under supervision of State superintendent; authorizes leg, islature to provide for county superintendents and other officers; provides for State school fund, and makes governor, State superintendent auditor, and treasurer the board of school fund; directs present school districts to remain until changed by law; requires legislature to appropriate for support of free schools the interest of school fund, net proceeds of all fines and forfeitures and of taxes provided for by constitution, and to provide that the people in each county and district shall raise such proportion as shall be prescribed by law; white and colored schools to be separate; and that no independent school district shall be formed without the consent of the district or districts out of which it shall be formed.

School laws, 1877.

The term district is defined to mean that division of territory which under the old constitution was known as a township, and is to be presided over by a board of education; independent district, a division of territory designated by special act of legislature; a subdistrict is a subdivision of a district, presided over by a trustee.

The county superintendent is to be elected biennially at the general election. At the same time the voters of each district are to elect a president and two commissioners, who are to constitute the district board, and also by vote determine question of tax or no tax.

The district board are to appoint 3 trustees for each subdistrict, one to be appointed each year for 3 years.

The district board are to determine number and salary of teachers, to appoint a secretary not a member of board, and shall cause to be kept up a sufficient number of schools for all persons entitled to attend; i. e., all youth between 6 and 21.

The trustees are under supervision and control of board. Trustees appoint teachers to be approved by board, and may remove same, subject to appeal to board. One or more schools to be established in every subdistrict for colored children when the number exceeds 25. The trustees of two or more districts may unite to establish colored schools. Whenever the benefit of free schools is not secured as aforesaid to colored children, the fund is to be divided in proportion to white and colored and their proportion expended by district board for the benefit of the colored children.

The school year commences September 1; school month is 22 days—20 days school and 2 days institute. The district board may establish graded and high schools, but must first submit question to voters of district.

The county superintendent and 2 teachers constitute a board of examiners to examine teachers; an examination fee of $1 is charged and applied to payment of two examiners. Teachers required to have certificate of county examiners, diploma of State normal school, or certificate from State board. Each teacher required to attend institute 2 days each month.

The president of board to examine school-houses once each year and report condition to board. Plans for new houses to be approved by county superintendent. District board may levy tax not exceeding 40 cents on $100 in any one year for building fund; also, to levy such tax as with State funds will keep up schools for 4 months each year, but not to exceed 50 cents on $100. Voters may authorize school for more than 4 months, and board levy tax therefor. Text books for the State schools are prescribed by statute, and county superintendents are to see that these are used and no others introduced. The State school tax is 10 cents on each $100, to be added to the interest on the State school fund

and other sources of revenue and applied to the support of free schools, and to no other purpose whatever.

WISCONSIN.

Article X of the constitution provides for a State school fund; requires the legislature to provide for a system of district schools, as nearly uniform as practicable, to be free to all children between 4 and 21; that each town and city shall raise for public school purposes an amount equal to one-half of amount received from State, and vests supervision of public instruction in a State superintendent and such other officers as the legislature may direct.

Law of 1878.

The State superintendent is elected by the people biennially, and county superintendents in same manner.

The district system is in force in this State. A town, if it so votes, may be one district, and the districts in it subdistricts, or it may be divided into districts. In the one case the town, and in the other the district, controls the schools.

Each district elects a director, treasurer, and clerk for three years, one to be elected each year.

The district may levy tax for teachers' wages of $350 for 15 scholars or less, $450 when over 15 and less than 30, and $500 when from 30 to 40; for maps, &c., $75; and for library, $100.

The director, treasurer, and clerk constitute district board, and must act as a board. May levy tax, if district neglect; determine text books, not to be changed for three years; employ teachers; and exercise general powers of district boards.

Any town may by vote establish high schools, the officers to be the same as in a district and to constitute a high school board.

When town system is adopted the subdistricts are to choose a clerk, and the clerks constitute the town board. The town board are to choose a president, vice president, and secretary, who are to be the executive committee, the secretary to supervise the schools. Ample powers for the establishment, maintenance, and control of schools are given to such town boards.

ARIZONA.

School laws, 1875-1879.

The governor, superintendent of public instruction, and treasurer constitute the territorial board of education, the governor being president and the superintendent secretary. The probate judge of each county is ex officio county superintendent.

A board of examiners is appointed by the territorial superintendent for each county, the county superintendent to be chairman of the board.

Counties are divided into districts. The county superintendent may form new districts upon petition.

The territorial superintendent is to apportion school money to the counties under the supervision of the territorial board, according to the average attendance for the three months prior to January 1 of each year, and the county superintendent to the districts in same manner.

At each general election the voters of the district are to elect three trustees, who elect a clerk and treasurer of their own number and control district affairs.

Schools are to be kept open three months each year. The school month is four weeks of five days each.

Text books are prescribed by board of education. The territorial tax is 15 cents on $100 and the county tax not less than 50 nor more than 80 cents.

A census of children between 6 and 21 is taken annually by census marshal appointed by trustees.

DAKOTA.

Laws of 1877.

A territorial superintendent is appointed for two years by the governor and council.

A county superintendent is elected by people biennially.

He is to divide county into districts and apportion money to same according to number of children between 5 and 21, examine teachers, and have general supervision of schools of county.

Each district at its annual meeting elects a director, clerk, and treasurer, who are to be qualified voters and constitute the district board, one to be elected each year for three years.

The districts locate houses and have control of schools. May vote tax not to exceed 2 per cent. for building fund, 2 per cent. for teachers' fund, 1 per cent. for furnishing houses, and $25 for library. A scholastic census is made annually by the clerk of each district. A county tax of $1 on each elector and 3 mills on the dollar of taxable property to be levied annually for school purposes, and to be distributed to districts in the proportion of their school population.

County teachers' institutes are to be held, and an annual territorial one.

Text books may be prescribed by the territorial and county superintendents and district school officers in conjunction, not to be changed for three years.

DISTRICT OF COLUMBIA.

The school laws of the District of Columbia are found in acts of Congress and the ordinances of the cities of Washington and Georgetown prior to June 1, 1871, the acts of the legislative assembly from that date to June 20, 1874, when it was abolished, and orders of the District commissioners since that date. At that time the white schools were

under the control of three boards of trustees, one for Washington, one for Georgetown, and another for the county. The colored schools were placed by act of Congress under a special board of trustees, with almost unlimited powers.

Subsequent to July 1, 1874, the District commissioners assumed the authority to consolidate these four boards into one consisting of 19 trustees, 11 to be residents of Washington, 3 of Georgetown, and 5 of the county. This continued until the act of Congress of June 11, 1878, section 6 of which, so far as it relates to the public schools, provides—

> That from and after July 1, 1878, * * * the board of school trustees shall be abolished, and all the powers and duties now exercised by them shall be transferred to the said commissioners of the District of Columbia, who shall have authority to employ such officers and agents and to adopt such provisions as may be necessary to carry into execution the powers and duties devolved upon them by this act.

This is plain and explicit, and no doubt could arise as to its meaning if it had stopped there, but this clause follows:

> And the commissioners of the District of Columbia shall from time to time appoint 19 persons, actual residents of the District of Columbia, to constitute the trustees of public schools of said District, who shall serve without compensation and for such terms as the commissioners shall fix. Said trustees shall have the powers and perform the duties in relation to the care and management of the public schools which are now authorized by law.

In one breath the existing board of trustees is abolished and their powers and duties transferred to and vested in the commissioners of the District, who may employ the necessary officers and agents to carry the same into effect; and in the next it restores the board and provides that they shall have the powers and perform the duties which are now authorized by law. Does the last repeal the first, or are the trustees merely the "agents and officers" through whom the commissioners may act? Taking either clause by itself there is no difficulty of construction, while taking both together there is a manifest conflict.

As a matter of fact, the schools have continued under the system which has grown up under the action of the old boards of trustees. The order of September 9, 1874, consolidating the then existing boards, was a virtual repeal by the commissioners not only of then existing District laws but of acts of Congress; and if they are vested with this authority it may not be easy to define what laws are in force.

IDAHO.

The school laws in force in 1879 make the controller of the Territory ex officio superintendent of education and the county auditor county superintendent.[1]

The county commissioners are to appoint an examiner, who, with the county superintendent, is to examine teachers.

Each county may be divided into convenient districts, and each district is authorized to elect three trustees for term of one year.

[1] In two counties the probate judge is superintendent.

All actual resident taxpayers are voters in district, except married women and minors.

The county school tax is not to be less than two nor more than eight mills. All fines for breach of penal laws are applied to support of schools.

The interest on proceeds of sales of public lands is apportioned to the counties by the treasurer of the Territory in the ratio of number of children between 5 and 21.

The county superintendent apportions money to the subdistricts, one-half equally and one-half per capita. No subdistrict having less than 10 children of school age entitled to share.

Teachers must hold certificate from county examiners, and are charged a fee of $3 therefor.

MONTANA.

School laws to 1877.

A superintendent of public instruction is to be appointed by the governor and council for two years, with power to adopt a course of study, as well as rules and regulations, for the schools.

A superintendent is elected by the people for each county biennially.

Counties are divided into school districts, and new districts may be formed by county superintendents on petition.

Each district elects a board of three trustees and a clerk. The trustees are elected, one each year, to serve three years. Vacancies are filled by county superintendent. Taxable electors are voters in the district.

The clerk is to take census of children between 4 and 21, Indians not included.

The schools are to be open for the admission of all children between 5 and 21, residents of the district. Separate schools may be provided for colored children.

The school month is 20 days, or 4 weeks of 5 days each. The school day is 6 hours, but teachers may dismiss all under 8 years after 4 hours.

County institutes are to be held annually in counties of 10 or more districts, sessions from 2 to 5 days, and teachers are required to attend. Teachers must hold certificates from the county superintendent.

The trustees may establish high schools by vote of district.

The school revenue is the interest on proceeds of sales of public lands, and of fines, a county tax of from 3 to 5 mills, and an optional district tax.

No district is entitled to share unless 3 months' school has been kept up and a duly licensed teacher has been employed.

NEW MEXICO.

No district school system appears to have been adopted in this Territory, and whatever laws are found are fragmentary and crude.

There is a provision for the election of four supervisors for each county, who are to have sole and entire control of the schools and school funds.

A poll tax of $1 is imposed upon every male over 21, to be applied exclusively for schools, and there is a further provision that in the settlement of the accounts of each county at stated periods any surplus remaining to credit of county in excess of $500 is to be transferred to the school fund.

A few years since a bill for the establishment of a free public school system passed one branch of the legislature, but was defeated in the other. Apparently there is a sharp contest between sectarianism and the friends of the free school system.

UTAH.

School laws to 1878.

The territorial superintendent is elected biennially and a superintendent for each county at the same time.

The county court is to divide each county into school districts.

Each district elects a board of three trustees, with the usual powers and duties, to serve for 2 years.

The county court also appoints a board of examination to examine and license teachers.

Text books are prescribed by the territorial and county superintendents and the president of the University of Deseret, meeting in convention for that purpose. School terms are arranged by the consentient action of the county superintendents and the trustees of their several counties.

The territorial school tax is 3 mills. The district trustees assess a tax of ¼ of 1 per cent., which may, by a two-thirds vote of district, be increased to not exceeding 3 per cent.[1]

The territorial tax is apportioned by superintendent according to the number of children between 6 and 16, which number is ascertained by an annual school census taken by the district trustees.

WASHINGTON.

School laws to 1877.

A superintendent of public instruction is appointed by the governor and council for a term of two years, also one person from each judicial district, who with the superintendent constitute the board of education

The board are to prescribe text books and rules for the government of the schools, sit as a board of examination, and grant teachers' certificates.

[1] Apparently to supplement the sums derived from these two sources there is an annual territorial appropriation of $20,000, with the proceeds from a tax on railroads and from the sale of estrays.

The county superintendent is elected biennially, who with two persons selected by him constitutes a county board of examination.

Districts are established by the county superintendents on petition of residents.

Each district elects a board of three directors, one to be elected each year for three years. Every person who has resided in the district for three months next preceding the meeting may vote, whether male or female.

Two or more districts may unite to establish graded schools, or any single district may have them. A city or town of 500 or more school children is required to establish such schools, and one with 400 inhabitants may compel the attendance of children between 8 and 16 years old at least 6 months each year.

Every district of 15 or more children of school age must maintain at least three months' school each year to entitle it to apportionment. The school month is 4 weeks of 5 days each. The school day, 6 hours; for primary schools, 4 hours.

Teachers' institutes are to be held in each county with 10 or more districts annually and one for the whole Territory must also be held annually by the territorial superintendent. Text books, when adopted, are not to be changed for five years.

Districts may vote tax, not to exceed 10 mills, to maintain their schools or furnish additional school facilities; meetings for this purpose not to exceed two in any year. All other school moneys are apportioned to the districts in proportion to their number of youth of school age (4–21), as reported by the district clerks.

WYOMING.

School laws to 1878.

The territorial librarian is superintendent of schools. The county superintendent is elected by people, and is to divide his county into districts.

Each district is to elect a board of three trustees, one to be elected each year for three years. The trustees are to choose of their own number a director, treasurer, and clerk.

All citizens and taxpayers over 21 who have resided in district for 30 days are voters, women included. Women may also hold office.

The district determines number and length of schools, provides houses and may vote money therefor, and may raise not exceeding $100 for library.

The district board are to make all contracts, and, with county superintendent, may establish graded schools.

The schools are to be free to all children between 7 and 21.[1] Where

[1] Three months' attendance annually in some school is made a duty (unless in the case of invalids and others excused by the school board) for all children of school age; and parents or guardians who neglect or refuse to send to school children between 7 and 16 years of age are liable to a fine of $25 for every offense against this rule.

there are 15 or more colored children in any district separate schools may be provided.

No discrimination in pay of teachers is to be made on account of sex.

A county tax of 2 mills is to be levied annually.

CONCLUSION.

Like all other statutes, the school laws of the States are subject to change or amendment at the will of the legislatures.

In no State is the system claimed to be perfect; but, on the contrary, the reports of the State and other supervisory officers freely criticise the workings of the systems and frequently suggest amendments.

In the Report of the Commissioner of Education for 1875 will be found a brief statement of the system in each of the States. A comparison of these with the present will show that few changes have been made in many of the States, and that where they have occurred they are mainly in details. In a few States changes have been made which are not in the direction of progress.

The history of the common school system, however, shows that wherever the free school system has once obtained a foothold no retrograde movement can be permanently successful. Local or sectional prejudices may retard its progress, but the good sense of the people will in the end triumph over all obstacles.

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CIRCULARS OF INFORMATION

OF THE

BUREAU OF EDUCATION.

No. 4—1880.

RURAL SCHOOL ARCHITECTURE.

WITH ILLUSTRATIONS.

WASHINGTON:
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1880.

CONTENTS.

LETTER.

DEPARTMENT OF THE INTERIOR,
BUREAU OF EDUCATION,
Washington, D. C., September 30, 1880.

SIR: A concise yet complete treatise on the proper construction, heating, and ventilation of school buildings has been a desideratum. Works of this character written in other countries have been found quite unsuitable here, and the same objection applies for the South and West to most works written in the Eastern States. The efficient ventilation of school buildings is also a matter not well understood by the majority of builders and certainly is not provided for in most buildings now erected for school purposes.

After much consideration I requested Mr. T. M. Clark, a well known architect of Boston, to undertake the preparation of an article which would be specially serviceable in the construction of school-houses in rural districts and in small villages in every part of the country, and which would include the latest and best information not only about the construction and ventilation of school buildings, but also as to their decoration. I transmit the result of his work.

Mr. Clark has applied his technical and artistic knowledge as an architect to the conditions required by the uses to which the building is to be put. His paper has been carefully revised, and will, I trust, prove satisfactory to teachers and school committees in general.

The aim in the paper is not so much to lay down rules to be inconsiderately followed as to give principles and directions suggestive of the plans best to be adopted under a variety of circumstances. It has been thought well in this connection to add in an appendix a brief selection from School-Houses and Cottages for the People of the South, by C. Thurston Chase, respecting the construction of log school-houses.

It is hoped that, at an early day, the Office may answer by a further publication some of the many inquiries in regard to buildings for high schools, academies, and colleges.

I recommend the publication of Mr. Clark's paper as a circular of information.

I have the honor to be, very respectfully, your obedient servant,

JOHN EATON,
Commissioner.

The Hon. SECRETARY OF THE INTERIOR.

Approved, and publication ordered.

A. BELL,
Acting Secretary.

SCHOOL ARCHITECTURE.

The subjects treated of in this work will be divided as follows:
Site;
Aspect and Lighting;
Surroundings;
Arrangement;
Construction;
Ventilation;
Heating;
Sanitation;
Acoustics;
Attractiveness and Economy in Building;
Specifications and Contracts.

SITE.

It should be unnecessary to say that whatever conditions of dryness of soil, sunny exposure, or remoteness from malaria or nuisances of any kind are desirable for a dwelling house ought to be still more earnestly sought in the case of school buildings, where the most sensitive and helpless members of the community spend the greater part of their waking hours under circumstances which render them peculiarly powerless to repel noxious influences if such exist. It is well known that persons engaged in active physical employment enjoy immunity in the midst of effluvia which would seriously affect them in a quiescent state, and children in school are especially open to the attacks of noxious miasms, chills, contagions, or impure air not only from their state of physical inaction but from the concentration of their attention upon study to the neglect of their bodily sensations. As the long continuance and daily repetition of the exposure exhaust their natural powers of resistance, it is inexcusable cruelty to them to neglect the simple precautions by which at least comparative salubrity may be so easily attained.

The first essential of a suitable situation is dryness.

Presuming the lot to be an acre in area, which may be considered the standard size, no permanent moisture should be found upon its surface; nor, in malarious districts, or indeed in any, is it safe to permit the existence of depressions in which the water collects in heavy rains to retreat gradually in dry weather, leaving its muddy border exposed to the heat of the sun. Such spots are the worst possible

breeding places of malaria. They should be drained by ditches cut through them in the dry season as deep as possible, and filled with loose stones, or even brushwood, and the hollow should then be graded up considerably above the surrounding land. If there is much water or the soil is very compact, the drain should be carried, by means of pipes if convenient, to some outfall at a lower level. Grading alone, without drainage, is useless; the water collects just as before, only concealed by the loose new material. With proper drainage, the newly added earth, kept dry beneath, will gradually settle down to about three-fourths of its original bulk, and, with the help of the sod which will grow over the surface, the wet place will be permanently cured. In rocky districts, a lot situated on a side hill is very apt to be springy, and such springs are not easily stopped. Fortunately, running water in this form is comparatively harmless, and if all the hollows which hold the water are cleared out, so as to give the currents an uninterrupted descent, their vicinity may not be harmful, provided that no springs exist under the building itself and that the approaches to the school-house are so managed that no stray streamlet may cross the path in rainy weather to wet the children's feet; but such a lot is useless for a playground, and would be best avoided. In general, any dry location will be suitable, whether level or sloping. Even a very bleak and exposed spot is preferable to a sheltered one which shows signs of dampness.

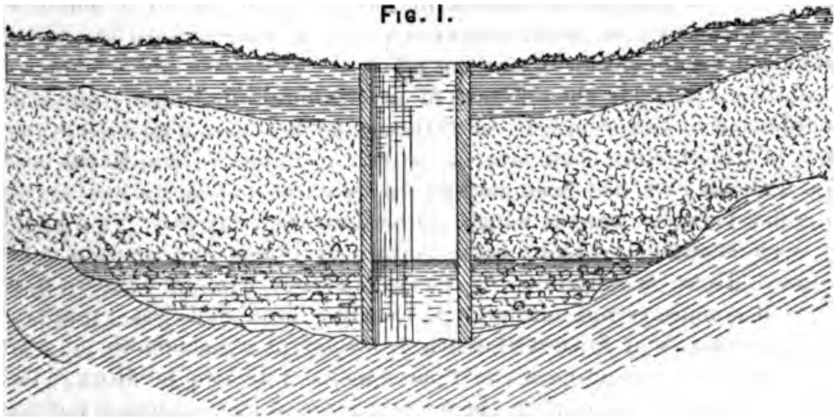
Care, however, should be taken to see that water is procurable and not too far off. In regions without public water supply a good well becomes one of the most important features of a suitable school-house lot. Every school should have one of these for its own exclusive use, near enough or rather at a suitable level with regard to the building to allow the water to be easily pumped into it. For this purpose the surface of the water in the well should not be more than 20 or 25 feet at the utmost below the first floor of the school-house, and some thought should be taken as to the relative location of house and well before either is decided finally. In many places the safest course would be to bond the land for the proposed site by a conditional agreement to purchase at a given price provided water were found of good quality and in sufficient quantity by digging a well of moderate depth in a position which should be determined upon as being most convenient to the intended building. Then the well might be and should be dug at once at the point fixed upon as most suitable in all respects for the use of the school, and if a good supply of water were obtained one prime requisite for a satisfactory house would be certain of being fulfilled; if not, the town would have spent only the cost of the trial well, which would be a very small sum, as little or no steining would be needed for this purpose.

This would be far better than buying or accepting a lot blindly, trusting to fortune to decide whether the school-house to be built upon it should possess that rare blessing, a good and convenient supply of pure

water, or be obliged to put up with a makeshift well, perhaps dry in summer, very likely situated at a distance, or, if near, probably poisoned by the oozings of the school cesspool or of the neighbors' barnyards, or by some of the corruptions which are known to contaminate the well water used in the majority of country buildings.

By careful observation of the ground, it is not difficult to locate with tolerable certainty the points where wells can be sunk with the best prospect of finding water. It should be borne in mind that the subterranean water from which wells are supplied moves through the ground in rivulets and larger streams which run along the depressions in the lower strata in the same way that the visible brooks and rivers do upon the surface, each stream draining an underground watershed of a certain extent. If a well is sunk anywhere on the line of one of these subterranean brooks, water will be found; and the first thing to be done, in selecting a spot to dig, is to determine the location of such streams as may exist below the surface of the given lot. In alluvial soils, where "hardpan" or some similar stratum of earth forms the impervious layer above which the ground water collects, the various depressions and valleys in the hardpan are generally indicated by corresponding though slight depressions in the natural surface immediately above them, and the course of these almost imperceptible surface hollows having been once traced, a well sunk on the centre line is pretty sure to reach the middle of the underground channel, and thus intercept whatever water may flow through it.

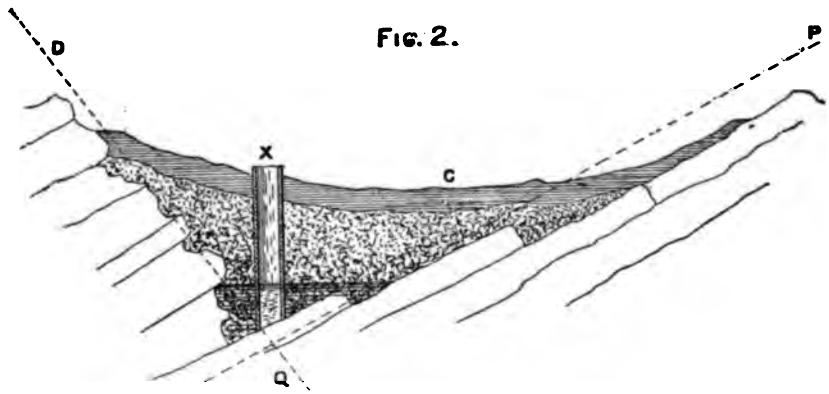
FIG. I.



A basin, Fig. 1, on the surface would indicate a similar hollow below, forming a subterranean pool, but as one of these may not exist in a good position relatively to the proposed building, it is generally quite as well to trace the course of the smaller underground brooks until one is found which flows conveniently near, and tap it in the most suitable place. In rocky districts the course of the ground waters is more difficult to follow. The subterranean channel, or *Thalweg*, is there often not below the mid

dle line of the corresponding depression in the surface soil, but at one side of it or the other, according to the inclination of the strata or the cleavage lines of the rocks in the locality.

Fig. 2.



Thus, in Fig 2, which shows a section of such a depression, the main channel of the water flowing over the ledge is to be found, not under C, which would be the lowest part of the natural surface, but under X, some distance toward one side. However, an approximate estimate of the probable position may generally be made by judging where a line, P Q, drawn at the edge of the valley at the angle with the horizon corresponding with the general inclination of the strata, would intersect another line, D Q, drawn from the other boundary of the valley and following the general inclination of the surface of the ledge, which is shown by the portion which crops out, and can also, to some extent, be detected from the profile of the soil above it.

In granite regions this method of ascertaining the water courses is complicated by the occurrence of seams, sometimes actual fissures in the rock, but more often small trap or greenstone dikes, in which the foreign igneous rock has been broken up by natural cleavage into small irregular crystals, among which water flows quite freely. The granite itself sometimes breaks up in certain directions in a manner very similar. These seams, however formed, usually contain water, often in great quantity, and, although they may extend to so great a depth that the water will be out of reach, it is well to trace such as may be detected in the outcroppings of the ledges, and to keep in mind those whose direction would bring them toward the position selected for the well. This may then be sunk near the seams, but not directly over them. If water is found independent of them, it is best to avoid them, for if they should be deep they might only serve to drain off beyond recovery all the water in the well as soon as the connection was made; but, if other sources fail, the excavation may be extended to them with some hope of success, especially if the vein descends from higher ground.

After the positions of the subterranean collecting pools or channels

are determined with reasonable probability, care should be taken to trace the sources from which they gather their waters. In rocky districts especially, impure water flows unchanged over the surface of the buried ledges or through their seams for long distances, and it should be positively ascertained that no barnyard, graveyard, stable, sink, drain, vault, cesspool, or other nuisance contributes anything, even during the heaviest rains, to the school-house well. If there is any suspicion of contamination, the well must be dug in another place.

The most suitable position of the well on the supposed line of the underground flow having been fixed, a trial excavation will soon show whether water exists in sufficient quantity. If the exact channel should not be struck at once, the excavation will probably show on which side it is situated, and the well may be extended toward that side. If copious springs are reached, nothing more is necessary than to dig out a shallow basin below them and then stein up the pit. If they are feeble, although probably sufficient, it is best to sink a deep excavation below them.

A better supply may perhaps be thus reached, and, if not, the pit will serve as a reservoir, increasing the capacity of the well by so much. When all is ready, the well is to be steined up with rough stone or brick; the upper two or three feet should be built with hard brick in cement, and a brick dome in cement should be built over the top, leaving a fifteen inch manhole covered by a flat stone, set in cement. A well so built will be reasonably free from drowned toads, worms, grasshoppers, and other animals, and if the suction pipe to the pump be made with the immersed end of block tin, as it should be, the danger of poisoning the children in their drinking water will be reduced within comparatively small limits.

In alluvial, sandy, or gravelly countries, the tube or driven wells have some decided advantages. They are cheap and clean, the strainer at the point and the tight iron tube effectually preventing contamination from surface water or dead animals. In case of need, several tubes can be driven and coupled together, multiplying the capacity very greatly, but a $1\frac{1}{4}$-inch tube will generally supply all the wants of a small school. These wells are patented, and a royalty of $10 is now exacted by the patentee for each well, but the device itself is simple. The tube consists of ordinary wrought iron steam or water pipe, sometimes galvanized, but more commonly enamelled either with the common black enamel or the red rubber coating of Morris, Tasker & Co., of Philadelphia. Sometimes the tin-lined iron pipe made by Tatham & Bros., 82 Beekman street, New York, is used, although it is more costly. The point is made separately and screwed to the end of the pipe before commencing operations. It is hollow, about $1\frac{1}{2}$ feet long, and pierced with several hundred small holes whose united area is considerably greater than the sectional area of the tube. For most wells pipe is employed $1\frac{1}{4}$ inches in internal diameter, and points are furnished ready made of that size,

but can be made of any dimensions. A section of tube, with the point, is driven into the ground by a mallet or a machine like a small pile-driver, according to the hardness of the ground, care being taken to keep it vertical. A piece is screwed to the pipe to hammer upon, so as avoid battering the pipe. When one length is driven home another is screwed on and sunk in the same way, and so on until water is reached. Various modifications are employed for particular soils, but the principle is the same in all. When completed, the well is connected with the pump by a 1¼-inch suction pipe, either directly or with the intervention of an air chamber and check valve, if the height from the water to the pump exceeds 27 or 28 feet. The cost of such a well driven in the vicinity of the larger towns is about $2 to $2.50 a foot in average soils where water is reached at a depth of not over 20 or 25 feet, including the royalty, together with the necessary point and tubing of enamelled iron. Another kind of driven well is made by boring, after the manner of an artesian well, under Pierce's patent. In this a 6 or 8 inch hole is bored first and a 2½-inch pipe afterward put down. The cost of this kind is about the same as the tube well, and they are sometimes successful where the tube wells fail to find springs. Besides they can be bored with perfect ease through the hardest rock or masses of bowlders, where a pipe cannot be driven. The cost of rock boring, with lining tube, &c., is about $7.50 a foot. It is a peculiarity of all these wells that the supply increases after use, the flow of ground water toward the strainer opening for itself by degrees a freer passage.

The water supply once secured, the next step should be to determine the position of the building upon the ground, which cannot, or should not, be definitely done before the successful sinking of the well. In general, a spot should be chosen from which the ground slopes naturally in every direction, if such can be found sufficiently near the level of the well to make sure that the lift from the water surface to the pump in the building will not be too great. A site of this description will afford a dry basement.

Side hills are less desirable, as excavations in such situations are apt to be occupied in wet weather by temporary springs due to the flow of water from the higher land above. If, however, a sloping site is unavoidable, the springs and water courses should be carefully noted after and during some heavy rain before the excavation is commenced, and avoided as far as possible. Level ground may be bad or good according to circumstances, but if wholly or partly surrounded by higher portions it is sure to be wet.

Any moisture which may show itself under the proposed building must be cut off permanently by drains. Water flowing down a slope toward the site may best be intercepted by a semicircular trench inclosing the upper part of the building, a few feet distant from it. The trench should extend some inches below the level of the lowest part of the excavations for the building, and agricultural tile laid, or loose stones or

at the worst brushwood thrown in until it is half full. Then straw, hay, or the common eel-grass, which is the best of all, is to be placed on top in a layer 6 inches deep and the trench refilled with earth. If much water is found, the drains must be continued to some outfall, into a street gutter, for instance; if not much, the soil at the bottom and ends of the trench will probably be able to absorb it. Even when the building is raised above the ground on posts, the subsoil should be protected from dampness by cutting off at least any moisture flowing through from underground springs at a higher level. If a continuous foundation wall is intended, whether inclosing a basement or not, the soil within the inclosure should always be protected on every side from the entrance of ground water by excavating the trenches for the cellar walls 18 to 24 inches deeper than the proposed bottom of the basement and 6 to 8 inches larger all around than the walls. In clayey or damp soils, or in any soil if the building is to cover more than 2,000 superficial feet, the depth of the trench below the cellar bottom should not be less than 24 inches, and the vacant space in the trench outside of the foundation walls 8 inches, unless the stone is particularly square and well faced. If water stands in the trenches they must be graded to one corner, from which a drain pipe can be carried to some outfall. This being arranged, the trenches are to be filled to within 6 inches of the finished cellar bottom with dry pebbles, or broken stone or brick, well rammed down.

From this point the foundation walls are to be started in cement, the first or footing course of the cement wall to be a little larger than the ones above it. The foundation walls should always be laid in cement mortar throughout, and if of stone should have the best face outside and neatly pointed. The extra width of the trenches will permit this to be thoroughly done. As fast as the wall is built the extra space is to be filled up with gravel. By this means the cellar of the building will be doubly protected against dampness. Not only is the appearance of the ground water above the floor prevented by the drains beneath the walls, which collect and convey it away as fast as it rises, but the moisture, which in rainy weather trickles through the sides of the trenches and quickly penetrates walls built close against them, is intercepted by the shield of loose gravel, through which it descends, and is carried off safely by the drain beneath the footings. The smooth outer face of the wall facilitates this descent, and, there being no projections to retain water anywhere, the masonry soon dries. Where the outer side is, on the contrary, left rough, with the joints unpointed, every projecting stone and every unfilled crevice catches a part of the water which trickles down by it and conducts it to the interior, causing incurable dampness.

These few precautions, which cost almost nothing when applied at the right time, are of great importance to the future usefulness of the building. Without a dry subsoil the most careful heating and ventilation will not secure a wholesome house, while, independent of considerations of health, the larger quantity of fuel required to sustain a given tem-

perature in a place where much of the heat must be absorbed in vaporizing condensed moisture, as well as the rapid waste by deterioration of the iron and wood work exposed to a damp atmosphere, will soon show the folly of neglecting to employ all possible safeguards at the commencement of the undertaking.

Further details of construction will be found in their proper place.

Second only in importance to the requirement that the site of the building shall be well drained and dry is the consideration of proper aspect and exposure. Together with these, regard must be had to the available means of approach and the position with respect to the road. Although this last matter is of comparatively little importance, inasmuch as an intelligent arrangement of porches and a little judicious planting will give the structure a good effect, whatever may be its angle with the street, still, it should not be overlooked, and, indeed, there is no more certain way of giving picturesqueness and charm to a building than ingenuity in varying its plan from a given model to adapt it to different circumstances.

Neglecting for a moment the consideration of position with respect to the street as well as to aspect, the exposure of the building when completed and the relative force of certain winds in the given locality should be noted. Not that the arrangement or lighting of the rooms will need to be altered on account of the greater or less exposure of the building to any given winds if care is taken in the construction, but to insure that this care shall not be forgotten, as well as to take advantage of natural features of the ground for modifying the discomforts of a bleak situation, so far as may be without detriment to more important interests, it is well to devote some attention to the subject at the outset.

In our climate the winds most to be guarded against are the northwesters of February and March; and, if the building stands on the side of a hill sloping north or west or if a valley running in that direction between neighboring hills directs the current upon it, extra precautions should be taken to cover the studding of wooden buildings with inner boarding and felt paper on that side, to glaze the exposed windows with double thick glass (which is many times less pervious to cold than the single thick), and to arrange the chimneys so that the stove or furnace may be placed well over toward the coldest corner.

Trees, especially evergreens, may with great advantage be planted to break the force of the cold northwest winds and even of the southeast gales, which, though of rarer occurrence, are in some localities excessively violent. A small obstacle is sufficient to affect the force of the wind very materially. A slight elevation or even a large bowlder will shelter a considerable space on its lee side, and, indeed, a defence not too extensive is preferable to an overhanging cliff or a hill higher than the building, the vicinity of which on the side from which strong winds come is sure to cause annoyance by down draughts in the chimney.

ASPECT AND LIGHTING.

For aspect it is hardly necessary to say that a gentle inclination of the ground toward the south is especially desirable; the charm of land so situated is well fixed in the minds of most persons. Next to this the playground may slope east or west; not north, if it can be avoided.

After all these considerations have been weighed, if the school-house plot still offers a choice of several sites, all equally well fulfilling the requirements we have noted, the further selection between the different situations may be allowed to depend upon their relative position with regard to the road. While no point of healthfulness or convenience for the pupils should be sacrificed for the sake of pleasing the eyes of the loiterers in the streets, it is generally found impossible to keep a well used playground as neat and trim as a lawn, and for this reason it will be better with small buildings, other things being equal, to set the school-house between the road and the centre of the plot, reserving the portion behind it for playgrounds, while the smaller space in front may be ornamented with flowers and kept neat and attractive. The entrances should be so placed that, without altering the aspect of the school-room itself, both of them may be visible from the street. Otherwise than this, the position of the building and the direction of the street have no necessary relation to each other.

The essential consideration which should determine the orientation of the school-house proper absolutely, without reference to street lines or grades, is the lighting of the several rooms. We know that the sun rises in the east, is at its highest point in the south, and sets in the west; we know also positively the good and bad effects of different kinds and degrees of lighting and varying amounts of sunshine upon the eyesight and health of children; hence we can deduce plain rules for laying down the lines of the rooms which they are to occupy, and these rules cannot be violated in deference to a real or supposed necessity without detriment to the usefulness of the building.

It is agreed by all authorities that the most comfortable and wholesome light for the eyes is that coming from one side of the room, without interfering crosslights from windows in the opposite side or from front or rear, and it is furthermore desirable that the light should come from a group of windows, or a single one, rather than from a succession of them separated by wide piers, which cast annoying shadows.

For writing or drawing the light should come from the left, not exactly at the side, but a little in front; then neither the head, the right hand, nor the pen will cast a shadow on the paper. For reading, the light may come from either side, indifferently, but should be a little back, that it may shine brightly on the page. For any purpose, the window must not be far off, or the light will be too dim, even though it may come from the right quarter.

In arranging the more important schools, containing four or more

class rooms on a floor, only two modes of lighting are practicable: one, by windows in two adjacent sides; the other, by windows in one side only.

Of these two alternatives, the latter should always be chosen. The confusion of crosslights at right angles to each other and the shadow of the head thrown forward are injurious to the eyes and the slight advantage to be gained for ventilation by windows in the adjacent sides of a large room is not sufficient to weigh against the defectiveness of the lighting so obtained. The openings in the one illuminated side should be numerous and large, or the more distant portions of the room will be too dark, and the seats should be so arranged that the light in each room will fall upon the left side of the pupils.

Under this arrangement, with lofty rooms and large openings, the comfort of the eyes is at its highest point, and it is therefore compulsory n all German schools of every grade, and has become a common requirement in planning the better class of school buildings in this country.

For our climate, however, it may be seriously questioned whether, in small houses of one or two rooms, the value during the hot weather of the cross ventilation obtained by opening windows in two opposite walls should not compensate for the inferior quality of the lighting.

Some French schools have endeavored to meet the difficulty and combine good light with ventilation by piercing two opposite walls with windows and then concealing those on one side by permanent screens, like blinds, which allow the air to pass, but not the light.

This expedient answers for high and well lighted rooms, but there is a further difficulty in the fact that in our low studded district and ungraded schools it is impracticable to admit from a single side sufficient light to supply the needs of the scholars. The minimum approved proportion of window opening for a school room is set down at one-sixth of the floor area, most authorities demanding much more. In one of our average rooms, 30 by 40 feet, the necessary window area would thus be 200 square feet. Unless this amount of glass surface is provided, the pupils in the parts of the room farthest from the windows will suffer from insufficient light, which is far worse for the eyes than any possible crosslights. Now, a simple calculation will show that, supposing the ceiling to be 12 feet high and the windows to extend from a line 4 feet above the floor to within a foot of the ceiling, to obtain the amount of opening demanded would require a succession of windows, say, 3½ feet each in width occupying the entire length of the longest side of the room, with piers between only 12 inches wide. It is plain that such a construction, though not impossible, is very different from anything which has ever been seen in our country school-houses; yet nothing short of this would give the remoter parts of the room even a bare sufficiency of light, and not that if any darkening by shades or blinds were permitted.

From these reasons it follows, we think necessarily, that whatever may be the best practice in large buildings, whose high stories admit

the requisite surface of glass without reducing the piers to an impracticable slenderness, and where artificial or forced ventilation keeps the air fresh without effort, small buildings of cheap construction can as a rule be neither properly lighted nor efficiently ventilated without windows in two walls, and these walls should be those on the right and left of the pupils as seated.

By this arrangement ample window space can be easily given, with allowance for partial darkening by blinds at times; the light, though less comfortable to the eyes of perhaps half of the pupils than would be that from a single direction, will be more comfortable to the remaining half, and far more so to all, teachers included, than would be the case with windows in two adjacent walls, while the advantage of being able to change the air of the room in a few moments by opening windows in opposite sides, or by the same means to maintain a current in hot weather, is in our climate of very great importance.

Adopting, therefore, the principle of lighting by opposite windows, it is necessary to consider the most advantageous aspect for these windows; in other words, presuming that the openings will be made in the longer side of the parallelogram which constitutes the plan of the main schoolroom, the proper direction of the longer axis of the room is to be determined with reference to the effect of sunshine in the room at different times of the day.

So far as the comfort of the eyes is concerned, the north light is preferable, as it is comparatively unvarying, and through windows so directed there will be no sunshine during school hours, and therefore no need of shades or blinds, which are always to be avoided if possible. But the health of children in other respects suffers very seriously from the deprivation of the sun's direct rays, so that steadiness of light must be sacrificed to the necessity for admitting them. Even the German rules recognize this, and require that while no room shall have windows on two sides only drawing class rooms shall face the north.

Next to the north aspect, the steadiest light, as well as the greatest amount of sunshine, is derived from one due south, and while a south window receives the sun nearly all day the year round, the angle at which it enters is so great that the annoyance from it in hot weather is infinitely less than from the horizontal rays which stream through an east or west window at certain times. For this reason, a south exposure is both cooler in summer and warmer in winter than an eastern or western one, and while it secures the largest possible aggregate of sunshine, a south window needs less shading with blinds or curtains than any other except one facing north.

On the whole, therefore, although some authorities hold a different opinion, the writer believes that the main room or rooms in small school buildings will be best placed with the longer axis directed due east and west, and lighted by windows in the north and south sides only.

With windows in the east and west walls, as some advise, the sun s rays will indeed traverse the room from side to side, but only at the times when their purifying and light giving quality is at its least and their power of annoyance at its highest. Such a room is unendurable in summer afternoons without much pulling down of shades and closing of shutters, processes as disturbing to the quiet of the school as they are injurious to the eyes of the scholars, at the same time that the summer breeze is shut out together with the sunlight. In winter a room so lighted is chilled on either side alternately, according as the northwest winds of March or the easterly gales strike upon the exposed surface of glass, making the room difficult to warm unless by using two furnaces, one or the other to be used, according to which side may be the cold one for the time being.

With north and south lighting all these difficulties vanish. The condition of the room in relation to the furnaces will in winter be always the same, the north side being constantly cold and the south side warm, so that a single stove or furnace placed near the north wall will at all times diffuse its heat uniformly through the room. In summer the north windows will never need shading and those on the south only to a small extent. In winter the range would be much greater, though the annoyance would at that season be far less. In any case, the shading of a small fraction of the window surface will cut off all the rays which can possibly strike upon any desk, while a west window can be effectually shaded only by closing every crevice through which a horizontal beam can pierce. The advantage in hot weather of being able to have all the apertures on both sides of the room wide open, with fractional shades, if any, on the south windows, can be best appreciated by those who have tried both systems of orientation.

Nor is the sunning of the room by south windows less effectual, but more so, than by east and west. The most obvious influence of sunshine upon the atmosphere of a room is to set it in motion, the chemical processes of deoxidation or decomposition being too obscure for our senses; but both chemical and mechanical effects are produced with greater energy by the noonday beams than by the heating, though lifeless, rays of a horizontal sun, and the circulation between the north and south sides of a room lighted from both quarters is the more active and constant by reason of the great dissimilarity in their condition, one being always shaded and cold and the other always warm.

The shape and size of the sashes is an important matter.

The height of the room will be generally about 12 feet, and if the windows are carried to within 6 inches of the ceiling the total height of the frame will be $7\frac{1}{2}$ to $8\frac{1}{2}$ feet. So high a sash ought not to be over 3 feet wide, and both parts should be well counterbalanced, so as to encourage their frequent opening. A heavy or badly hung sash will rarely be opened, from the simple physical inability of teacher and children to manage it. A ring should be screwed into the top of the upper sash,

and a pole and hook provided to operate it. The glass should be in rather small lights for cheapness of repairs, and double thick on all exposed sides. The English double thick is heavier than the common kind.

Shades and blinds should be avoided as far as possible. Outside blinds are generally condemned by writers on school architecture, as liable to get out of repair and difficult to manage. Moreover, they require so much wall space to fold back against as to restrict the number of windows and prevent the grouping with small piers, which gives the best light.

Inside shutters may be used where brick walls or furred projections give the necessary space for folding them back; or, better still, Venetian blinds can be easily made or obtained which pull up against the soffit of the frame by means of a cord passing through holes in the ends of each slat, and attached to the lowest one. These are made both of wood and iron. Still better, but more costly, are the rolling shutters, which coil, by means of a spring, into a box either above or below.

The cheapest device of all is the ordinary shade, which should be made of stout holland, never of paper or painted cotton, and strongly and accurately hung. This has the objection of shutting out air in summer as well as sun, and a modification may be used, consisting in a short curtain, only half the height of the window and moving up and down by means of the ordinary brass pulleys and endless cords, to which it is secured along the edges by rings and hooks.

This will be quite sufficient to intercept all unwelcome sunshine, and will still leave half the window opening free for admission of air. The securing of each edge of the cord keeps the shade stretched and in good condition indefinitely, and no rollers or springs are required. For the north windows no shade whatever will be necessary.

It is important that the sills of the windows should be as much as 4 feet above the floor. If less than this they cause a glare in the eyes of the pupils sitting near them.

The danger which some writers fear that high window sills will develop an irresistible inclination on the part of the pupils to climb up on them in order to see out may be counteracted, perhaps, by increased effort to make the school room itself attractive.

To compensate for the height of the sills above the floor, the window heads should be carried as close to the ceiling as the construction will admit. Four inches is all the distance which need generally be given in frame structures, and even in brick buildings the sash can be carried nearly as high, as will be seen further on. The illumination of the ceiling so obtained is of the greatest value, the light reflected from it being peculiarly soft and grateful to the eyes, while the proper ventilation of the room is greatly assisted by making the windows as high as possible.

Aspect must also be considered in regard to the entrances, which, in a word, should always face the south. A south entrance gives a breathing place for the children in rainy or blustering weather as they approach

or leave the building and protection to the interior from the March northwesters or easterly rain storms, which will blow in at an outside door exposed to them with such force as to make themselves felt through the whole school-room whenever the door is opened; it gives dry and clean approaches to the building after snow storms, in place of impassable drifts; and last, but not least, shelter for those too punctual scholars who are sure to arrive before the building is open in the morning.

So important has experience shown the southerly aspect for entrances to be that to this necessity is perhaps due the fashion of east and west lighting for the school room proper. The "classical" style of school planning not being able to conceive of entrances in any other position than in the gable end of a building, a south door involved necessarily east and west windows, and vice versa. Now, however, the spectre of the Greeks has ceased to reign over our architecture, and whatever ingenuity is shown in contriving south windows as well as doors will be rewarded by the applause of the elders as well as the gratitude of the children.

There may be situations where a south exposure is impracticable for one or both entrances. In such a case, much may be done by contriving porches, which, although entered from the east or west, or even from the north, can have wide windows toward the south, and angles or screens which may shelter the early arrivals from the cold winds.

SURROUNDINGS.

The choice of site and orientation of the building being thus determined, certain details of planting and laying out the school lot remain to be considered before the requirements of the school-house itself are taken up. If anything in the size of the lot or the conformation of the ground prevents ample space from being given to the rear playground, it is much better to set the building as far back as possible, and give up the whole front space to the children's games. Not only will the available area be thus made the most of, but, if the school-house is judiciously arranged, the playground will be brought on the south side of the building and thus sheltered from cold winds, while the sun reflected from the walls will add much to its cheerfulness.

However the playground may be situated, it is best left clear, without interruption by trees or shrubs. These are only in the way of the children's sports, and they soon get mangled and broken by thoughtlessness or accident; their shade is of no use in such a place, and they are liable to be used as screens to conceal doubtful actions from the eye of the teacher, whose vigilance it is well that the pupils should never be sure of escaping.

The ground should be grassed over with the closest and thickest turf possible, and base ball stations and similar places of excessive wear should be shifted every few weeks, to prevent the sod from being trodden away entirely. Wherever the natural sod is good it is best to leave it intact, as a thick sod is of very slow growth. Defective places may

be patched during the construction of the school-house with sods from the site of the building and from the paths.

If new grading makes it necessary to raise the grass from the beginning, all the loam accessible should be spread upon the surface. Two feet in depth of rich loam is not too much; the growth of the sod will be much more rapid in such a soil; and the whole should be thickly sown with red-top grass, with a little admixture of white clover.

The front space, where such an area is reserved distinct from the playground, may with advantage be treated differently by planting with trees, particularly evergreens and flowering shrubs, only taking care that no tree of any kind is allowed to stand at a less distance from the school-house than twice its own natural height when fully grown. The good effect of trees is reversed by allowing them to stand too near a building. While they may actually be used to dry up a marshy spot, by the great quantity of water which they take up through their roots and disperse by means of their leaves into the air, these same roots, near a cellar wall, will keep it damp as would the vicinity of a great wet sponge, and the shade of their branches, if allowed to fall on the school-house, not only deprives it of so much wholesome sunshine, but the moving shadows on the windows or curtains cause a flickering of the light which is distressing and injurious to the eyes.

In its proper place, however, a considerable amount of planting is permissible, with the best results. Shrubs, rather than trees, should be chosen for the most part.

There are few portions of the United States where Missouri currant, barberry, Weigelia, cornel, laurel, lilac, roses (white, yellow, and red), viburnum or Guelder rose, California privet, Forsythia, spiræa, tartarean honeysuckle, dogwood, deutzia, holly, magnolia, catalpa, and rhododendron will not grow well in the open air on the south side of a building, and in the Southern States many more may be added.

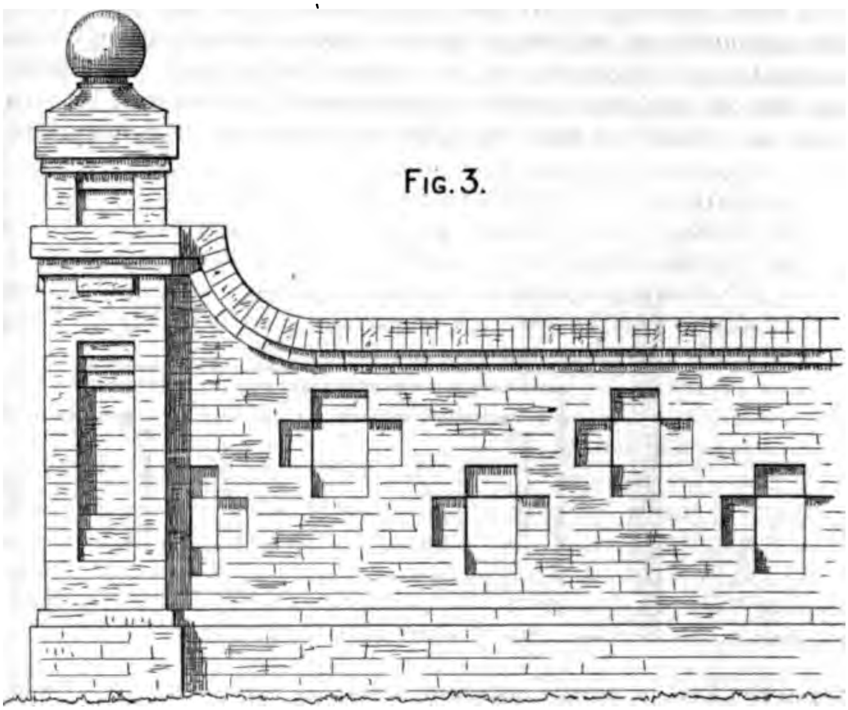
Damp spots may be improved by covering them with clusters of the beautiful pyrus japonica, and porches may be ornamented by climbing vines, such as ivy (English, German, or the small leaved varieties), woodbine or wistaria, roses and honeysuckles; and if any one will take the trouble to sow the seeds in spring, the red and white cypress vines, the fragrant jessamine, morning glories, and the purple and white Japanese clematis may be added.

Any experienced seedsman can suggest varieties enough to keep some of the vines and shrubs constantly in bloom for nine months of the year, and a judicious selection of seeds, supplemented by slips from private gardens and young shoots transplanted from the woods, will cost almost nothing, while the civilizing influence of their beauty upon the children's minds, together with the pride and interest which their gardening operations will awaken, should not be undervalued.

It is best to plant several varieties of shrubs together in clumps. The dark evergreens or the holly and laurel then set off the brighter kinds,

and the mutual protection which they afford each other against the winds helps the growth of all, while, if one should die, it may be removed without leaving an unsightly gap, and such gardening, especially if the bushes are planted directly in the grass, is less troublesome than the cultivation and training of regularly spaced rows of bushes or beds and borders of small flowers. The clumps should vary a good deal in size and in the kinds of plants comprised in them. A large mass may be set between the front of the school-house and the street and will add much to the attractive and retired air of the building.

FIG. 3.

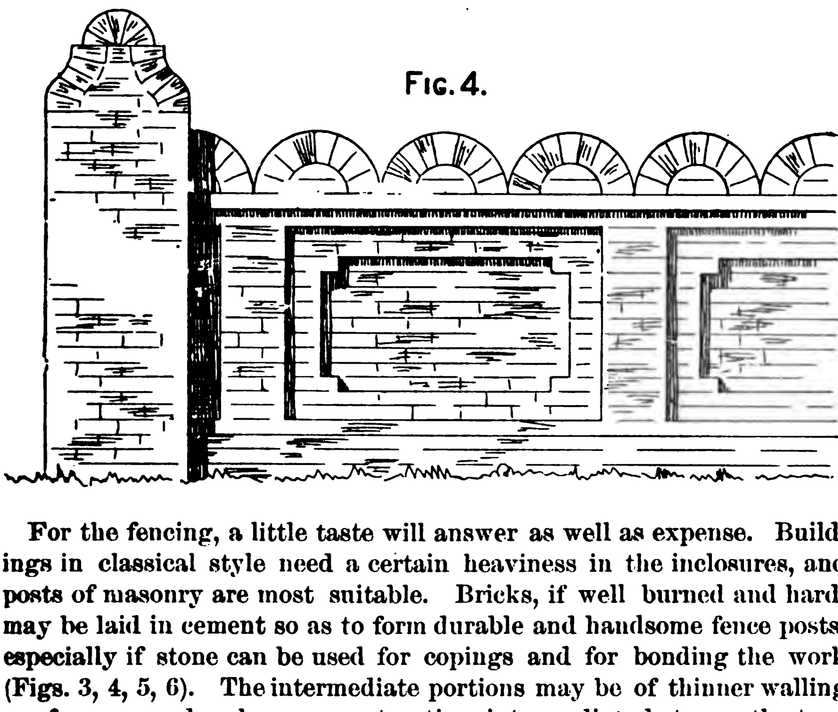


The grass in the front or ornamental ground should be fine and short, the ground neatly graded and abundance of loam placed on the top and sown with the seeds of such grasses as will form a thick and permanent sward.

The edges of the paths cannot be trusted to grow neatly with sowing only, however profusely the seed may be scattered: an edge about two feet wide must be sodded. For this, the best sods should be selected and laid on a deep bed of loam, thoroughly wet to receive them, and they should be kept moist for a few days. The walks themselves may, if gravel is not at hand, be made of coal ashes and cinders, which, though dusty at first, soon harden into a good surface. Coal tar concrete is, however, much the best material to use.

More elaborate landscape gardening will be well repaid in the general interest which a well laid out school-house lot will excite in the neighborhood, and the cost of all the work which can be applied to an acre of ground is not great. If a landscape gardener is accessible, his advice will be the best security against mistakes, but something may be done by unprofessional taste, keeping due regard to the style of the building, whether formal or picturesque. The structures of classic type, like the Grecian temples once fashionable for schools, and the Renaissance designs of some of our best modern buildings gain very much by a little terracing. This gives straight lines and smoothly sodded banks around them, and helped by a few garden vases of iron, or, better, artificial stone, which carry out, so to speak, the formality of the building into the landscape, softens the harshness of the contrast between them, and greatly increases the apparent importance of the structure.

FIG. 4.



For the fencing, a little taste will answer as well as expense. Buildings in classical style need a certain heaviness in the inclosures, and posts of masonry are most suitable. Bricks, if well burned and hard, may be laid in cement so as to form durable and handsome fence posts, especially if stone can be used for copings and for bonding the work (Figs. 3, 4, 5, 6). The intermediate portions may be of thinner walling or of open woodwork, or a construction intermediate between the two, consisting of wooden rails filled in with brickwork four inches thick (Fig. 7).

If creosoted lumber is used there is no danger of rot from the dampness of masonry.

For more picturesque buildings, the fencing may be wholly of wood (Figs. 8, 9).

FIG. 5.

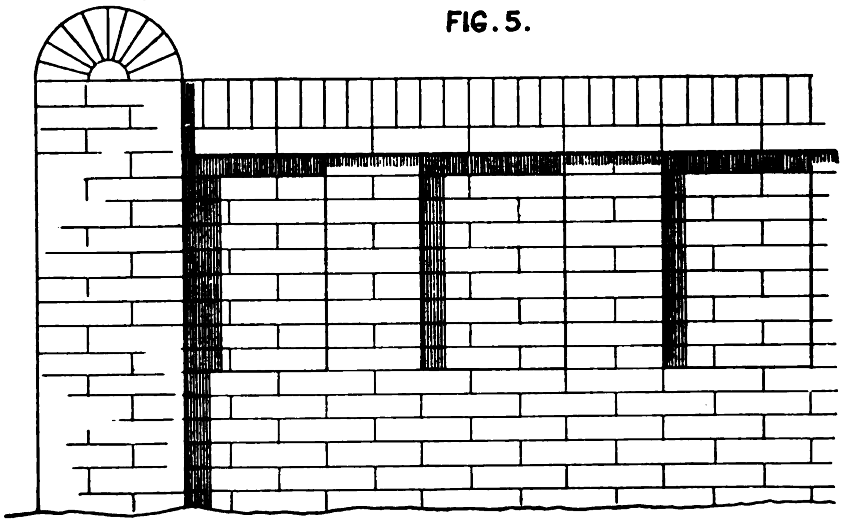
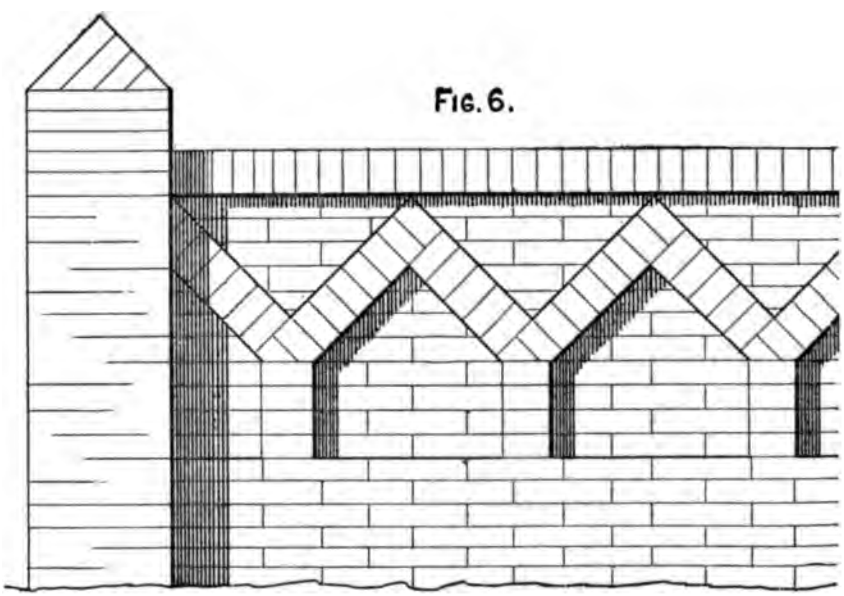


FIG. 6.



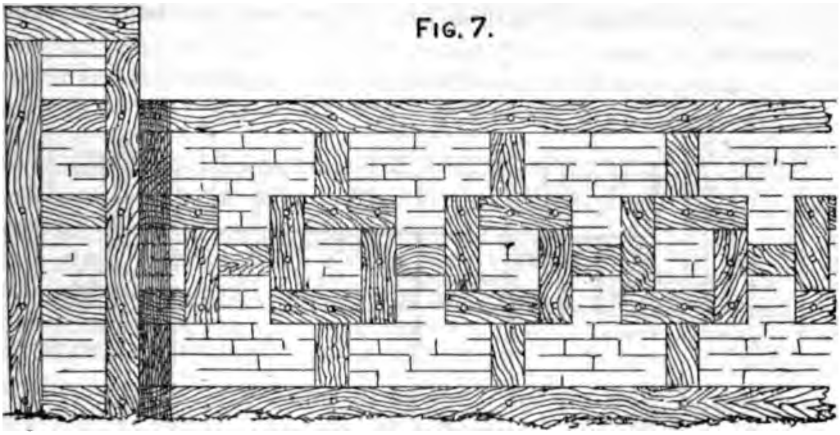


FIG. 7.

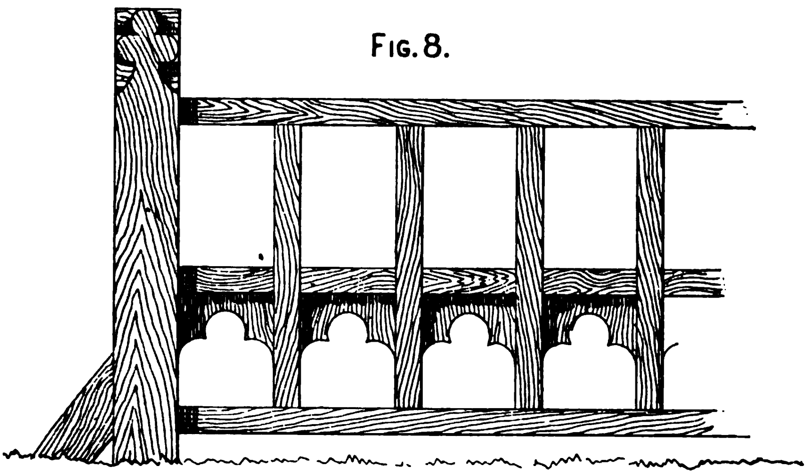


FIG. 8.

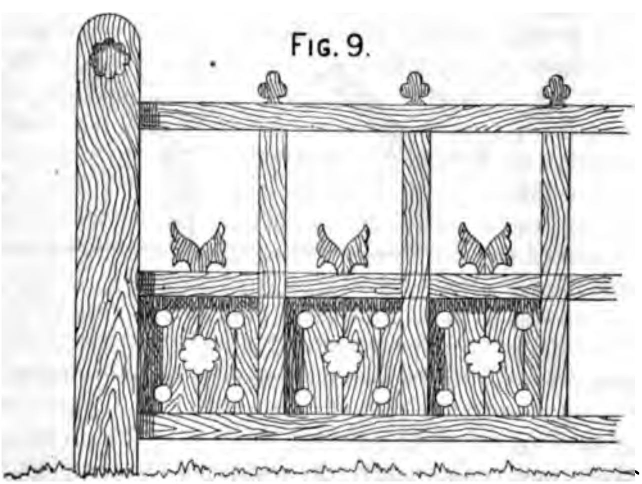


FIG. 9.

Very pretty and durable inclosures are made by landscape gardeners of red cedar or other durable poles, with the bark on, consisting of posts with top and bottom rails well secured together and the inter-

FIG. 10.

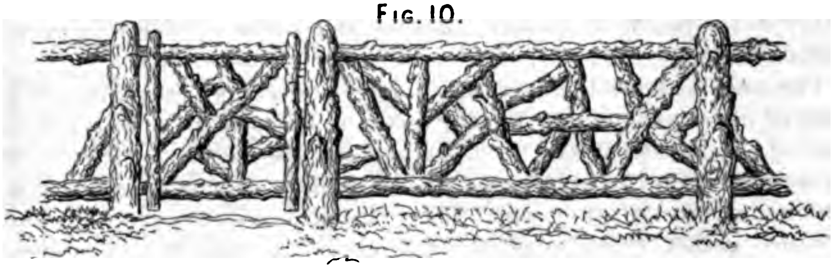
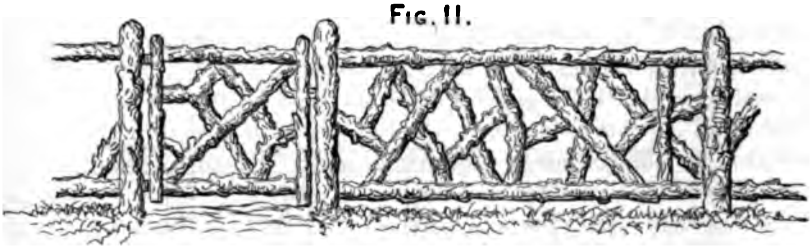


FIG. 11.



vals filled with pieces of random lengths nailed in in any direction, the only care needed being to keep the network so formed uniformly open, not thick in one part and thin in another (Figs. 10, 11).

ARRANGEMENT.

The arrangement of the school-house itself is now to be considered, keeping in view the requirements as to lighting and aspect of main room and entrances which have already been discussed and accepted as settled for all cases where imperative necessity does not overrule them. But if certain further general rules can be deduced from study of the habits and necessities of teachers and scholars, it does not follow that such rules will be universally applicable. On the contrary, there are few cases where a very considerable amount of ingenuity will not be necessary to adapt the form and arrangement of building acknowledged to be the best in theory to the different exigencies of situation, size, or cost which must to some extent govern in each particular instance; and it should be one of the recognized duties of school superintendents to see that a due degree of mental energy is expended upon the problem.

It is most unwise to delegate to the builder the task of shaping a model plan to fit a particular position. Not only will he generally lack the knowledge if not the disposition requisite for determining the dimensions of the rooms with that close regard to the number of pupils, the mode of seating, the kind and therefore the size of desks, the formation of classes and consequently the width needful for aisles, the best

mode of heating and ventilation under the given circumstances, which is necessary to success, but, even if fortified with what he supposes to be ample experience, his knowledge will very often prove to be derived from books or works which, however good in their time, have in the rapid development of modern sanitary and social science long since become obsolete.

Few persons know from actual examples how greatly the skilful planning of a school building facilitates the work carried on in it, but an idea of the possibilities of good planning may be negatively arrived at by observing the disadvantages of bad or ill considered arrangement, which may be studied in great variety in most of our country schools. Let any teacher, superintendent, or member of a committee, on visiting a school, notice for an hour or so the continual petty interruptions, annoyances, and distractions caused to pupils and teachers in ordinary school rooms by the moving about to stir up fires which have not a proper chimney draught or to pull down shades for excluding troublesome sunbeams; by the frequent rests, sometimes on the part of teacher, sometimes of scholars, to relieve the eyes from the painful glare of a front light; by the confusion and relaxation of discipline which follow the collision of classes in narrow doorways or of pupils in the tortuous and inconvenient passages among the desks, and the countless other annoyances which follow from the improper position of windows, desks, stoves, and doors, and he will realize how large is the weekly aggregate of time thus wasted.

The remedy for this is thought, the careful thought of some one thoroughly familiar with school business and ready to sacrifice all other considerations to the welfare of the school; one who can in imagination follow each scholar through his work and play, who can see before him the classes in order and sympathize with the trials and understand the duties of teachers and pupils. Such a man should sit in judgment upon every school-house plan, whether modest or pretentious, whether made by an architect or by the apprentices in the builder's shop.

In his criticism he should abandon at once all those preconceived notions of symmetry, proportion, classic elegance, or Gothic aspiration derived from books or from the vague recollection of a few examples which are apt to influence amateurs much more than architects, and devote himself solely to determining whether the heights of stories are too great for proper hearing or too small for ventilation; whether the staircases are wide enough and numerous enough for safety, and not too steep for little legs; whether the windows are sufficiently high and of suitable extent, and so placed that their light will fall where it is wanted; whether the ventilating and warming apparatus is well out of the way of the school operations, and, unless he can trust the architect's knowledge, whether it is judiciously planned in accordance with the latest practice. The dimensions of the rooms should be tested with reference to the desks to be put in them, and the width of the resulting aisles

between the desks calculated to an inch, in order that their sufficiency may be assured, while any superfluity of space may be curtailed.

This most necessary work of preliminary criticism, before plans of this kind are carried into execution, may be performed by any intelligent teacher or school superintendent, with the help of such guides and books of reference as may be procurable.

By such individual thought and criticism only can a thoroughly good mode of school planning be formed in this country, as has been done in England through similar censorship, with the imperative demand that certain requirements shall be fulfilled; and if the following notes are found applicable in suggesting and assisting such criticism, the writer believes that this work will be more serviceable than if he were to devote himself to the collection of a certain number of model plans, which, however interesting in themselves, are seldom of much service, except when interpreted by the light of well understood principles.

Taking up the component portions of the proposed buildings in the order of their importance, the main school room should be considered in a few words.

The form of this room would hardly need discussion if it were not that fantastic shapes are from time to time proposed and occasionally adopted. It is sufficient to say that the figure long proved to be best for hearing and seeing on the part of the pupils, with easy supervision on the part of the teacher, is a parallelogram, the length of which is a quarter or a third greater than the breadth. In the middle of one end is the desk of the teacher, who has his school thus before him, within reach of his voice and so disposed that he can observe every movement without turning his head or straining his eyes.

For supervision alone a long and narrow room would be most suitable, so that the whole school would be comprehended by the teacher within a comparatively small angle of vision, but sufficient width must generally be provided for drawing out classes, either in front of or behind the desks, and a compromise must be made between these two opposite requirements.

In accordance with the rules of lighting and aspect previously proposed, the room will have its longer axis directed east and west, and will be lighted by windows occupying nearly the whole length of the north and south walls.

The entrances, which must be separate for the two sexes, should be so planned that both boys and girls may be under the eye of the teacher in entering and leaving the room. They may be in the wall behind him, a very common position, but are better either in the side or opposite end walls, so that, without turning his head, his glance may follow them through the vestibules until they are out of the building. This plan will prevent the silly tricks which children carry on in the vestibules sheltered from the teacher's observation, to the amusement of their fellows but to the detriment of discipline. The best arrangement will be to

put one entrance door in the side wall, near the teacher's end of the room, and the other in the opposite end wall.

The side door may be appropriated to the boys, who will thus be nearer the teacher and more under his control in entering and departing, and the end door, which will be behind the pupils, to the girls.

The room being lighted alike on both sides, the pupils may sit facing either the east or west, but there are many advantages in arranging them to face the west. By this disposition the girls' entrance is brought on the sunniest and most sheltered part of the building, as it should be, and in interior planning the stove or furnace, which must be at the northwest corner of the room, comes in front of the pupils, where it finds the largest space and where its heat is diffused with the greatest comfort to all.

The best place for the blackboards is the end wall behind the teacher, the whole of which will be available, except what small portion may be occupied by doors to class room or teacher's room. If more space is needed, the opposite end wall may be used.

The piers beside the windows, though often fitted with blackboards, are unsuitable. The strain upon the eyes in trying to decipher marks on boards so placed, in the face of the glare of light from the windows, is very severe, and such positions, if occupied at all, should be left for coarse maps and diagrams on a large scale and in bright colors.

In the simplest cases, the large school room and its separate entrance porches or vestibules for boys and girls, with wardrobes for each and connected outbuildings, will form the whole of the structure.

More important buildings will have in addition a teacher's room and one or more recitation rooms; but these can and should be joined to the main body without interfering with the disposition, aspect, or lighting of either school room or entrances, the requirements for which are the same in houses of all the lower grades.

A good rule for vestibules is that the outside doors shall be placed at an angle with those opening from the vestibules into the school room. This will cut off the direct impulse of the wind and exclude draughts with ten times the effectiveness of outside and vestibule doors in parallel walls. They should be light and sufficiently spacious to give the crowd which pours out of the school room doors at recess a little breathing space before they are pushed into the open air.

Attached to each vestibule should be a large wardrobe. These may open directly from the school room, and should always do so where there is danger of their being robbed, but the smell of wet clothes in rainy weather, especially in poor neighborhoods, is penetrating and disagreeable, and a better disposition is to open the wardrobes from the vestibules, these being at the same time so arranged that the teacher can observe everything that goes on in either of them.

With panels of clear glass in the inner doors, these can be shut with-

out interfering with this supervision, which is useful also for other purposes.

Besides the wardrobes, each vestibule should be furnished with wash-bowls and roller towels. It is not necessary to have expensive plumbing to enable teachers and children to keep themselves as clean as they desire. All that is needful is a common cistern pump in each vestibule, with a lead or enamelled iron suction pipe to the well, and an earthenware or tinned copper basin, or sink if preferred, with a waste pipe to a dry well outside. This will cost a trifle, perhaps $50 in all, if the well is not far away. At 6 per cent. interest, this would bring the cost of keeping a school of 50 pupils clean up to 6 cents each a year.

A further investment for towels and rollers, with weekly allowance for laundry, is advisable, but not absolutely necessary.

The pumps may be had with a pin hole in the valve, so that the water cannot stand long enough in them to freeze, and traps in the waste pipe may be dispensed with as unnecessary, so that there will be no other part of the apparatus to be injured by frost.

On no account must the waste pipe empty into the privy vault. By such carelessness will not only foul gases be poured into the vestibules, wardrobes, and school room, but the admixture of water renders the contents of the vault doubly offensive and dangerous.

In towns with public water supply the arrangement will be a little different, but some means of cleanliness may always be had. If nothing better offers, the rain water of the roof can be collected and used.

In regard to certain other appliances for cleanliness and health, perhaps the most essential of all, much must depend upon circumstances. The distance between the best and the worst is so enormous that the writer can do no less than urge most earnestly that the very best apparatus should be always used where it is possible, at the same time that he considers it his duty not to overlook the very poorest and cheapest contrivances, which must sometimes of necessity be endured.

It is sometimes asserted that a school privy should never be under the same roof as the school room, and certainly it should not open into it, nor should the vault be placed where its contents can by any possibility contaminate the soil beneath the school rooms, but with proper construction and ventilation it can be brought without offense, if not under the same roof, at least within reach of sheltered and decent communication, and one improperly built and cared for should not be allowed upon a school-house plot in any case.

The advantages of placing the closets in communication with the school room are numerous. To say nothing of the dangerous exposure in winter to a delicate child in leaving a hot room and traversing perhaps the length of the playground to a miserable shed through which the wind blows freely, or of the no less injurious repression of the natural functions which the dread of such exposure occasions, the blunting of the natural modesty of children and the opportunity of corrupting themselves and

others which is afforded to the degraded ones by the shiftless, indecent, and promiscuous arrangement and condition of the ordinary school privies urgently demand that these necessary appliances should receive at least as much care as the other circumstances of school life.

How deeply children may be dragged down by their school associations is well known to experienced teachers and physicians, and even the public is sometimes startled into attention by the revelation of the condition into which such influences, joined to the horrible knowledge derived from the books which certain criminals delight to scatter among the young, may bring a school. Even young children are liable to have a bias given to their thoughts which they will bitterly regret in later years.

For these reasons all the delicate precautions with which good architects help the occupants of dwelling-houses to conceal from each other any suggestion of the degrading necessities of their common nature are tenfold more necessary in planning for school children, whose minds are far more susceptible to the influence of their material surroundings, while they have not the restraint of intimacy and affection to check prurient curiosity.

In the first place, the conveniences for the two sexes should be absolutely separated, out of sight and out of mind each from the other. They should be well ventilated, a little off the main thoroughfare, but not at the end of a long passageway, nor in any place where one must pass by a window or across a door to reach them. They should be, however secluded, in the same group as the wardrobes or woodshed, so that a person passing in that direction is not necessarily going to or from them. This seems a small matter, but it is not; it is one of the established rules of planning among architects, and especially in planning for children, whose modesty it is peculiarly necessary to consider. Yet the closets should not be far removed from the observation of the teacher, or even from supervision by the public opinion of the scholars. As the dark and filthy outhouse, scrawled with obscenity by wandering tramps, induces carelessness in children, if nothing worse, so a light and neatly finished closet, with proper provision of urinals and water tight floors, will be an object of pride even among boys, and they will readily cooperate with a teacher in keeping it clean and discountenancing the filthy habits of the rougher class. But, to remove temptation, all should be light, open, and in a sense public, each latrine to its own sex. There should be conveniences enough for all the children, dark corners should be avoided, inside as well as outside the building, and such angles as cannot be dispensed with should be overlooked by windows from some frequented place. Even clumps of shrubbery should be so arranged as not to form retreats for careless or dirty boys. This care in arrangement, so that no part of the building or grounds can escape observation, is of great value in assisting discipline, breaking up bad habits among the scholars, and encouraging manliness and modesty.

Having arranged the position of the retiring places with due regard to convenience, unobtrusiveness, cleanliness, and privacy, the kind of apparatus to be employed is next to be decided. Independent of cost, the question whether water closets, earth closets, or common privies should be used depends upon the amount of care which can be given to them. A good water closet is undoubtedly the best appliance which we have, but it involves an expense in drainage and supply which is seldom allotted to country schools, and the risk of being rendered useless by freezing is considerable, especially with the best closets. Those which are called "hoppers" can be arranged with the trap below ground, out of reach of frost, but unless by good fortune there is a large and constant supply of water these are liable to become serious nuisances. In general, it is well to remember that the stench from an inferior or dilapidated water closet is more penetrating even than that of a foul privy, and that a privy vault can be disinfected much more easily than a bad drain. In ordinary cases, the best resource is some form of earth closet, which, when properly cared for, is inodorous and is equally available in all weathers. The form of closet employed should be specially designed so that the scattering of the earth over the matter in the vault may be done by an independent mechanism from the outside. In this way the pulling of a lever or turning a crank once a day will accomplish all the requisite disinfecting, and the weekly visit of an intelligent laborer, who should make the rounds of the school-houses to fill up the reservoirs of dry earth and remove the contents of the vaults, will be all that is necessary to maintain the sanitary condition of the buildings. Further details will be found in their proper place.

If the town is unwilling or unable to do even this much for its children, the common privy vault must be accepted as a necessity. In that case, although it is both practicable and advisable to retain it in close connection with the school room, provision should be made by a short vestibule, ventilated by blind slats in the sides, or some similar arrangement, for intercepting and sweeping away the emanations of the closets before they can enter the rooms. By this precaution, with a small and tight vault ventilated as hereafter described, little or no nuisance can reach the school room.

The school room, vestibules, wardrobes, and closets will in some cases constitute the whole of the plan, but most schools will require, in addition, either a woodshed for storage of fuel or a space for cellar stairs, if the basement is used for that purpose.

As a rule, unless furnaces are set in the basement, it is both better and cheaper to store wood, and still more coal, in a shed on the ground level than under the school room floor. Some coal, especially when wet, emits sulphurous vapors in considerable quantity, and any old wood pile furnishes evidence that the fermentation of sap and the decomposition of animals give rise to vapors which are best removed from all possibility of contaminating the school room air.

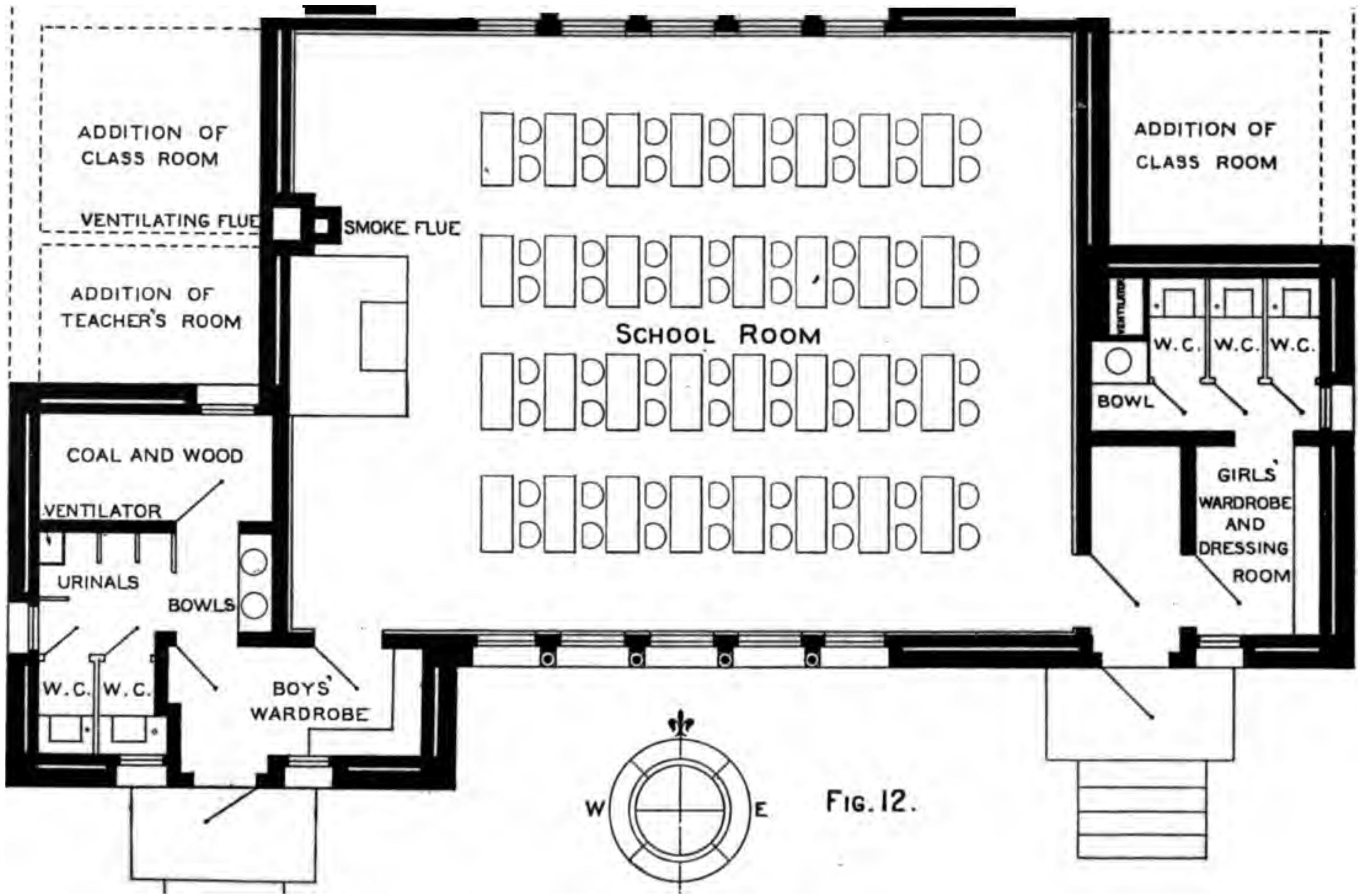

ADDITION OF CLASS ROOM
VENTILATING FLUE
SMOKE FLUE
ADDITION OF TEACHER'S ROOM
SCHOOL ROOM
ADDITION OF CLASS ROOM
VENTILATOR
W.C.
W.C.
W.C.
BOWL
GIRLS' WARDROBE AND DRESSING ROOM
COAL AND WOOD
VENTILATOR
URINALS
BOWLS
W.C.
W.C.
BOYS' WARDROBE
W
E

FIG. 12.

The woodshed may adjoin the boys' vestibule, and by placing it on the northwest corner it will serve to shield the vestibule on that side from the cold winds.

These divisions constitute the simplest form of school-house. For convenience of reference, a plan fulfilling the requirements so far noted is given here, showing (Fig. 12) the main axis of the school room directed east and west, the two porches facing the south, the girls' entrance door opening in the end wall opposite the teacher's desk, and the boys' door in the side wall beside the platform, the woodshed adjoining the boys' vestibule, with suitable arrangement of closets and wardrobes.

In the plan given, the outside steps may be covered by a gabled roof, which protects them from rain, snow, and ice, and the consequent decay, and gives the children who bring umbrellas an opportunity to get under shelter before closing them, while the gabled form prevents the snow-slides and dripping eaves common to picturesque porches.

The most desirable position for the stove being in the open space in front of the pupils and at the left of the teacher, and this being also, with the orientation here adopted, by far the most favorable position for warming the room uniformly in cold weather, it will be convenient to place the chimney in the northern part of the west wall near the stove. For an ordinary stove a flue 8 by 8 inches is large enough, but a chimney of a single flue of that size quickly bends over and finally decays, so that it must be made 8 by 12 or 8 by 16 inches, or, what is much better, a ventilating flue built in the same stack. The cost of the stack is not very much increased, and the advantage of having a ventilating flue in such a position, where the draught will be quickened by the heat of the adjoining smoke flue, is considerable. Besides, the solidity as well as the external appearance of the chimney is greatly improved by increasing its size.

The ventilating flue, if smooth inside, must be at least 20 by 20 inches; this is the smallest permissible sectional area of a warmed shaft, straight and smooth and of considerable height, for winter ventilation of a school room occupied by 48 pupils.

If a smaller flue is used, additional wooden shafts will have to be provided in other parts of the room to obtain proper movement of the air, and as the motion of the air in pipes diminishes much more rapidly than their sectional area, the cost of the wooden trunks will be found greater than that of the brickwork saved and the effect much less.

A consideration which should not be lost sight of in planning small schools is the possibility that it may become desirable to add one, two, or more recitation or class rooms and a teacher's room or library, and an arrangement of ground plan and elevations which will permit this to be done with the least alteration of the portion previously built will be very generally useful.

The plan given admits of such extension, as shown by the dotted lines.

The teacher's room and class room near the platform are well situated for use, and the position of the chimney is fixed where its flues can be used for the stoves of the new rooms and for ventilating the same. As the elevation shows (Fig. 13), the new roof can join the old without any alteration of the latter, nothing being necessary but to take off the boarding and finish from the walls next the new rooms, plaster, and cut the requisite doors.

Additional class rooms may be provided also at the opposite end in a similar manner, without interfering with any of the old doors, windows, or other parts of the construction; but, unless the building is heated by a furnace, rooms added at this end must be provided with a new chimney.

It sometimes happens that two large school rooms are required, and Figs. 14 and 15 show how the model plan may be doubled without sacrificing the better points of the arrangement. This double plan may have recitation rooms added if necessary.

In planning buildings of this class it is always necessary to keep in mind the requirements which are peculiar to the business of a small school, and to recognize the difference between them and the large structures with four rooms on a floor, where, for instance, it is the rule to place the axes of the building diagonally with the cardinal points, in order to secure sunshine in all the rooms, an object which is much better attained in the one or two roomed structure by placing it square with the cardinal points.

The dimensions and to some extent the shape of the rooms will depend upon the seating. The utmost number of pupils which should be allowed to one teacher is fixed by the best authorities at 48, and each teacher should have a separate room; but there are certain advantages in ungraded schools in having the school room large enough to accommodate a greater number. In country districts the attendance varies in character according to the season. In summer the larger children are occupied at home and the school is filled with small ones, while in winter the older boys and girls have leisure to attend but the inclemency of the weather keeps the little ones away; so that, although the average attendance may be not over 48 scholars, there should nevertheless be an extra provision of small desks for summer and of large ones for winter, increasing the number to about 60 places in all. Otherwise, in the cold season, stout children must be crammed into the infants' desks, and during the rest of the year some of the little ones will have to be seated at desks too large for them, with serious risk in both cases of causing malformation in the young and tender bodies. The additional air space gained is of value also, and, in a rapidly growing neighborhood, such a room may, in case of necessity, be temporarily utilized to its full capacity by the employment of a second teacher and the addition of recitation or teachers' rooms, if they do not already exist. The plans here given will therefore be arranged for about this number.

The exact dimensions of the main room will furthermore be dependent

Fig. 13

on the kind of desks used. It should be unnecessary to say that the proper way to plan a building of this sort is to determine the number and size of desks and the width of aisles and platform first of all, then to construct the walls to inclose just the space desired and no more; not, as sometimes occurs, to fix upon some haphazard dimensions for the room, and when it is ready cram the desks in somehow, the result being that the room presents in one place large useless spaces and in another aisles so narrow that the children can only squeeze through them sideways.

Taking things as they are, not as they perhaps ought to be, the majority of ungraded schools are likely to use double desks, and the plan will be first laid out for such, leaving till later the arrangement to suit the single desk seating.

The dimensions of double desks vary according to the maker, and the utmost economy of floor space will be secured by determining upon the kind to be used before commencing the construction of the building.

The folding seat desks, which are desirable, especially for young children (because they allow the pupils to stand upright in their places, turn the seats back, and in that position take part in various calisthenic or other exercises), occupy a little more room from front to rear than the old kind, but are made somewhat shorter, the average length being 40 inches for the double seat, and the floor space from back to back 30 inches.

The aisles between the rows of double desks should be two feet wide.

The teacher's platform, or a space for the desk if a platform is not used, will be 5 feet wide, and 3 feet, at least, must intervene between the front of the platform and the front row of desks.

Three and a half, or, better, four feet should be allowed between the rear seats and the wall, and aisles next the side walls are necessary, 3½ feet wide if blackboards are to be placed there, or 3 feet if they are dispensed with.

There should be not more than four rows of double desks. The advantage of shortening the school room by increasing the width is more than counterbalanced by the annoyance to the teacher of constantly turning the head in trying to take in a wide angle of vision.

Three rows of desks would give a room of better form still for seeing, hearing, and economical construction, but the width of such a room, amounting to 20 feet only inside the finished walls, would not be sufficient to allow the drawing out of large classes in front or rear of the desks. With four rows, therefore, as a standard, the desks, being 40 inches long, will require 13 feet 4 inches; three 2-foot aisles between them will add 6 feet; and the two side aisles, each 3½ feet wide, 7 more; making the total width of the room, inside the finished walls, 26 feet 4 inches.

For the depth, the teacher's platform will take 5 feet; the front aisle, 3 more; eight desks, at 2½ feet each, will add 20 feet; and the rear aisle, which must be 4 feet if there is any possibility of adding recitation rooms

on that end, brings the total to 32 feet, and gives seating capacity 64 pupils of all ages.

If it is decided to use single desks, which are rapidly supers double ones in the more intelligent communities, the dimensions room will with advantage and economy be somewhat different.

The usual width for aisles between single desks is 18 inches; six of desks, therefore, at 2 feet each, with five aisles, at 1½ feet, will 19½ feet; two side aisles will, as before, add 7 feet, making 26½ feet accommodate 60 pupils, there will be 10 desks in each row, at 2½ floor space for each, which, with 8 feet in front and 4 in rear, giv feet for the depth of the room.

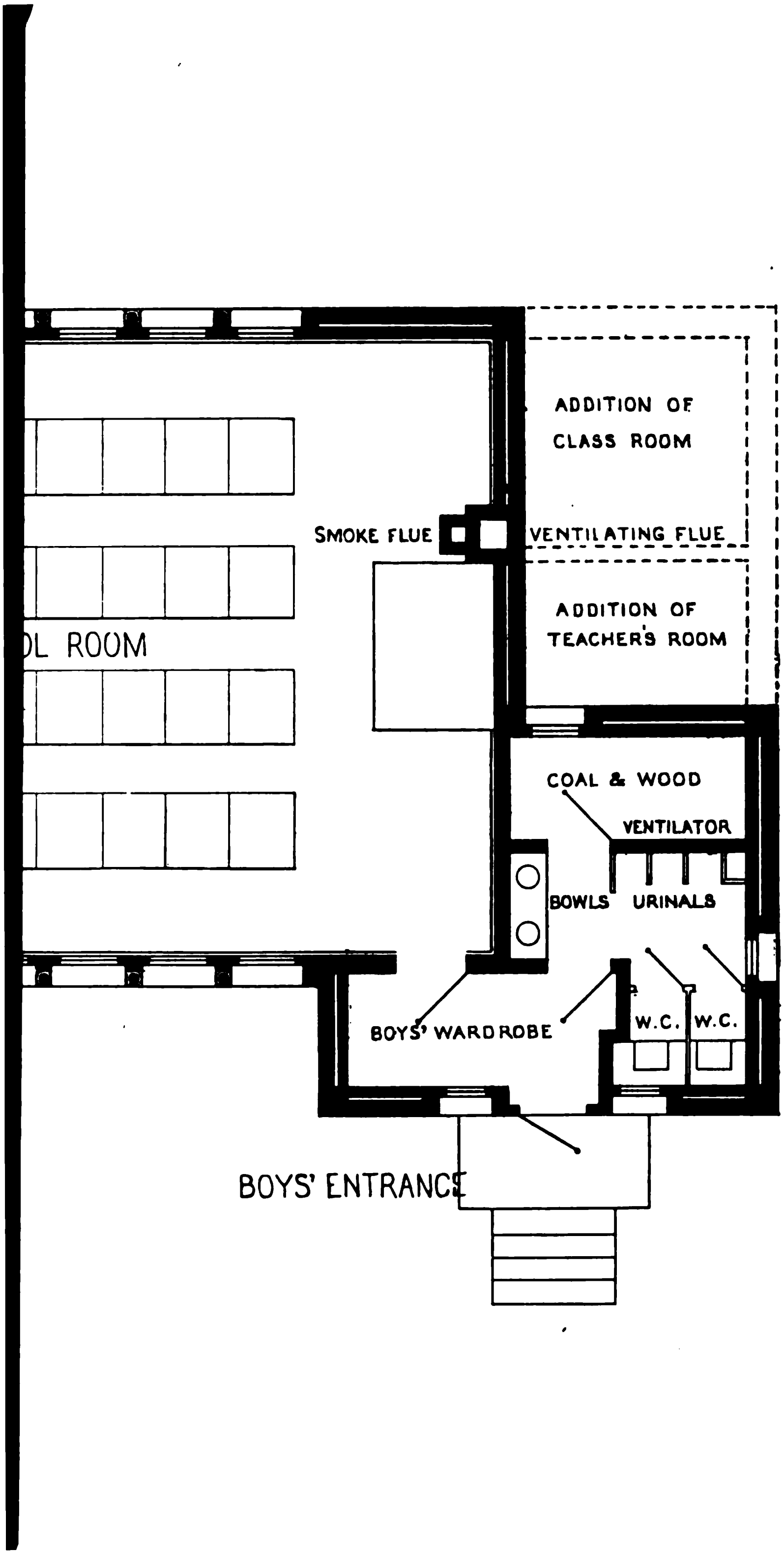
The height of the ceiling should not be less than 12 nor over 14 Thirteen feet is quite sufficient for any school room, and althoug volume of air contained in a lofty room is larger a comparativel one is more easily ventilated by flues and the air more quickly ch by opening the windows, and the acoustic quality of a room so n square as a school room must be deteriorates with great rapidity a height of ceiling passes beyond 12 feet. Lower posts still wou admissible in small rooms for 24 to 40 pupils, if the ceiling were c up with the roof by plastering on the rafters and collar beams, bu lar beams are hardly practicable in roofs of 25 feet span.

The window sills will be 4 feet above the floor, and the heads s extend close up to the plate, which will allow about 5 inches for trave.

A wainscoting should be carried around the room, or, at least, the blackboard ends. Under the blackboards it should be 2 feet 4 i high. This will be high enough to protect the dresses of the chi from the chalk, and will not bring the blackboards too high for co ient use. Usually the cap of the wainscot is formed of a gutter sh moulding to catch the chalk dust and hold crayons, but an inge carpenter can easily make a suitable cap by bevelling a square pi wood inwards.

The blackboards should extend 4½ to 5 feet above the wainscot, b ing the top edge 6¾ to 7 feet above the floor. One large one sh occupy the whole extent of the wall behind the teacher's platform, a similar one the opposite end wall, while smaller ones or maps be placed beside the groups of windows. Certain simple diag showing graphically the areas of different countries and their ductions have been made which will be very suitable for such pl A small moulding or batten may run along the top of the blackb as a frame.

The teacher's platform may be from 6 to 8 feet long and ab inches high. Some teachers prefer to dispense with it altogether, t ing that they can make their work more effective by moving about tinually on a level with their scholars instead of overlooking t quietly, but such cases are exceptional.


ADDITION OF
CLASS ROOM
SMOKE FLUE
VENTILATING FLUE
ADDITION OF
TEACHER'S ROOM
OL ROOM
COAL & WOOD
VENTILATOR
BOWLS
URINALS
W.C.
W.C.
BOYS' WARDROBE
BOYS' ENTRANCE

The stove, if the room is to be warmed in that way, should stand in the vacant northwest corner of the room; and, if furnace heat is employed, the furnace should stand nearly under the same corner, and registers should be placed in each angle.

In this way the delivery of hot air will be equal at each register, whereas, if the furnace were set in the centre of the basement, the delivery would in cold weather be mostly on the south side of the house the greater weight of air in the northern half of the room, chilled by the impact of the cold wind, being sufficient to determine the current away from that side.

The recitation rooms may be 10 by 15 feet, or even smaller. Their furnishing will consist of benches or specially designed seats around the wall and a small desk and a chair for the teacher. Blackboards should line the walls.

For a teacher's room almost anything, even a closet, is better than no such room at all. Six feet by ten is large enough to be of great use. Book shelves, hooks for hanging clothes, or, better, a small press, and a few cupboards, with two chairs and a small table, complete its furnishing. Neither teacher's room nor recitation rooms need be so high studded as the school room.

Wardrobes may be 12 inches deep, if there is wall space enough; if not, by making them 18 inches deep hooks may be put on the inside of the doors, and room thus economized. The hooks should be triple, of malleable or wrought iron, if the cost is not too great, and screwed to strips in two rows, one row being put 6 feet or so from the floor for the large scholars, and the other not over 4 or 4½ feet for the younger ones. The hooks should be 8 inches apart in each row, and those in one row should be vertically over the middle of the space between those in the other. Ten feet in length with double strips will give 30 hooks. Each hook should be numbered and one allotted to each child. Six inches over the top row of hooks should be a shelf, and the remaining space to the ceiling may be occupied with additional shelving.

For overshoes, the lower part of the wardrobe is, in the better schools, occupied with ranges of pigeonholes 4 or 5 inches square. Five inches square, or 4 inches by 6, is not too much in country districts at the north, where rubber boots need to be accommodated, and, if the case is made of half-inch stock, a wardrobe 10 feet long will give room for 30 boxes, numbered like the hooks, in two rows, with a cupboard in addition where lunch pails may be stowed away. A little ingenuity only is needed to secure the requisite accommodation in very limited spaces.

The whole should be shut in by strong doors, which may fasten with a slip bolt, or if preferred by a lock, the key of which will be retained by the teacher during school hours. Holes bored in walls and doors will give ventilation.

If it is possible to turn a current of warm air from the furnace in

among the clothes to dry them in wet weather the health of the children will be thereby promoted.

Water closets and privies are simple in arrangement, but a few suggestions may be useful. They are in the country generally made far too large. Two feet and a half is all the width necessary or advisable, and four feet in depth is sufficient. Never, under any circumstances, should there be two seats in the same inclosure.

If a special seat for young children is necessary it should be in an inclosure by itself; but with seats made rather low, 15 inches from the floor, and the holes not too large, all children of school age will be sufficiently well accommodated. It is sometimes necessary in rough districts to prevent standing on the seats in the boys' closets. This may be done by a wide board inclined from a little above the back of the seat, forward to a point nearly over the front edge, or by a strong bar 20 to 24 inches above the seat.

The boys should always be provided with urinals, which may consist of a trough of wood or iron inclined toward the outlet and the requisite number of board partitions, 18 to 20 inches apart; but a better arrangement, because of its greater privacy, consists in stalls divided by partitions as before, but each furnished with a separate iron urinal, enamelled, if the best and most durable article is desired. Corner urinals are in some respects the best, and a large number may be set in a small space by placing them on opposite sides of a zigzag partition. Whatever kind is used, the lipped pattern should be chosen. This saves the dripping and consequent foulness inevitable with troughs, or even with urinals of the ordinary shape.

The screens should be 6 feet in height or more. In very many delicate and nervous boys nature refuses to perform its usual functions, however great the necessity, in the presence of others or under unaccustomed circumstances, and a decent privacy in the school conveniences is necessary to save such from daily pain and often more serious consequences.

The urinals may discharge into a single pipe, emptying into the vault, and all woodwork above them should be well painted and sanded. The floor under them should, if possible, be of slate, marble, or concrete, with a gutter formed in it, draining into the main waste pipe. In general as little surface as possible should be exposed to defilement, and that little should be non-absorbent, and capable of being washed clean with a few pailfuls of water.

A few details of general planning may be best inserted here, and will serve to close the subject of arrangement.

All the doors from the interior of the school room to the exterior air should open outward. This precaution, which the law makes compulsory in city school-houses, should not be neglected in the smallest buildings. It is necessary, in consequence of this arrangement, to have a landing at the top of the outside steps at least 4 feet wide, so that a child

standing on the top step when the door is suddenly thrown open from the inside may have room to draw back without falling down the steps.

Double doors are often useful in large schools, but, if used, should be not less than 5 feet in width. Other doors may be 3 feet wide, and, in general, 6 feet 8 inches to 7 feet is sufficient height. It is a common mistake to have doors too high. If ventilation is provided for independently of them, as it always should be, the larger they are the greater will be the volume of cold air admitted when they are opened and the more danger there will be that they will warp and admit dangerous draughts even when closed. Fanlights over them, however, are useful in warm weather.

Stairs and steps of all kinds should be very low and easy for children's use. Five inches in height are enough for each riser, and outside steps may have treads 12 inches wide with advantage.

CONSTRUCTION.

The proper mode of construction for school buildings is hardly less important than suitable arrangement. More, however, even than arrangement, must it depend upon circumstances of local habit, relative cost of different materials, and the absolute expense allotted for the proposed building.

Nevertheless, there are certain principles of good building which are applicable to all materials, and these should be kept constantly in mind. Perhaps the simplest mode of making suggestions will be to describe, first, a model construction, in which the best ordinary materials for their several purposes shall be indicated throughout and described as employed in the best way; then, although circumstances will probably rarely admit of the literal following of the model, there will be few cases where it will not furnish useful hints as to the proper employment of such materials as may be used, and it will be of a certain use to have the model fixed in the mind, even though it be for the time unattainable.

As often happens, the common system is far from being the best or the cheapest in the end. All the disadvantages and dangers which follow from the adoption of the light and inflammable structure of studding and boards in dwelling-houses are multiplied when the same system is applied to schools, as many terrible occurrences bear witness, and in isolated cases very successful efforts have been made at an improved construction.

From the light of these experiments and similar ones, the best practicable construction for a school building of the humblest grade would be about as follows:

The site having been carefully selected and drained as before described, the cellar may be excavated to a uniform depth of about 3 feet below the original surface of the ground. The sod, if good, should be stripped off and utilized at once in improving the remoter portions of the lot. The loam should be piled separately, to be put subsequently on top of

the grading. The gravel or earth will be disposed of as the nature of the ground may require, but on a reasonably level spot all the excavated material will generally be used in raising the ground to a gentle slope around the building; not a steep bank, but a grade of one in ten or so. The trenches for the foundation walls should be dug 2 feet below the cellar bottom and 18 inches of dry stone filled in and rammed down before starting the walls; the excavation should be made 8 inches larger than the wall, as before described, and the wall carried up with smooth outside face to the height set for the under side of the first floor. This will vary according to circumstances. If the building is to be warmed by a furnace, the height of the basement should be about 8 feet. Not only is anything less than this insufficient to give head room under the hot-air pipes, but the heating is much more certain where the basement is high enough to allow a good pitch to the hot-air pipes. If there is no furnace, 6½ feet clear will give sufficient head room, and, indeed, if the fuel is stored above ground, 3 or 4 feet under the beams may suffice. The thickness of the foundation depends upon the material and upon the thickness of the wall above. Where it can be procured, rubble stone, of granite, slate, greenstone, trap, or any of the harder rocks, makes a perfectly satisfactory foundation for a building of the kind proposed, being comparatively impervious, and therefore little liable to soak up ground moisture, to give it out again from the inner surface; while, for the same reason, the ground does not freeze to the outside in winter, gradually tearing to pieces a wall built of them, as it does a brick or soft stone foundation in cold climates. If the wall above is of rubble it will be usually 16 inches thick, and the foundation must be from 20 to 24 inches thick, according to the character of the stone, rounded bowlders demanding greater thickness than the flat pieces of slate. A hollow brick wall above will be from 12 to 16 inches thick, and a 20-inch rubble or 16-inch brick foundation will suffice. A frame building, if there is a cellar under it, should have a rubble wall 18 to 20 inches thick, according to the character of the stone, or a 12-inch brick wall will do if it is protected against the pressure of earth from outside and from the disintegrating action of frost in clayey and clinging soils by a good thick

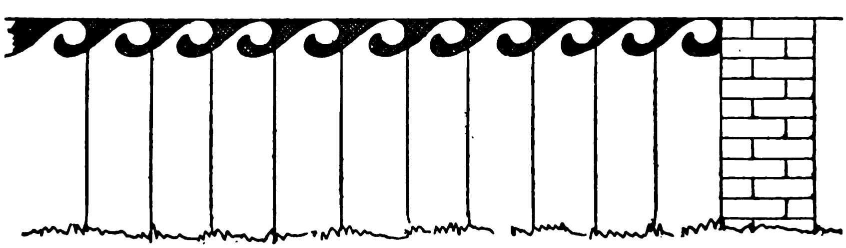


FIG. 16.

envelope of clean gravel. A solid 8-inch brick wall above will need a similar foundation. If no cellar is required, the trench wall for the foundation should still be 18 inches thick if of stone or 12 inches if of brick.

Nothing less than these will long withstand the winter frosts. In the South, frame buildings are very generally built on piers or posts, and with strong sills and good piers this is a durable and economical con-

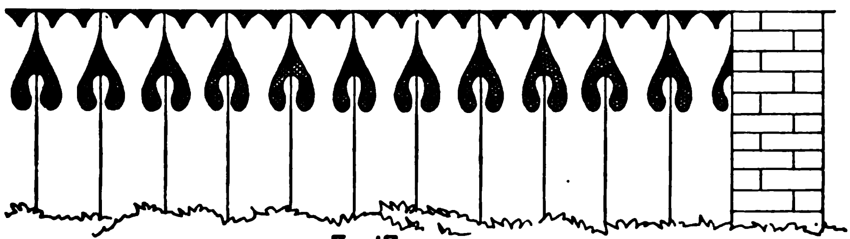


FIG. 17.

struction. It should, however, be frankly shown by raising the sills well above the ground. If earth is graded up against the sills they will

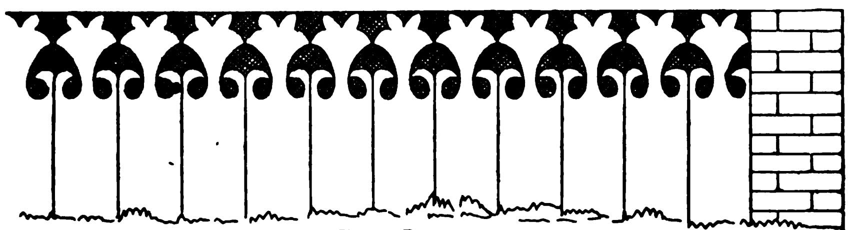


FIG. 18.

inevitably rot in a few months. The unpleasant looking hole beneath the sill may be filled with sawed sheathing, as in Figs. 16, 17, 18, 19.

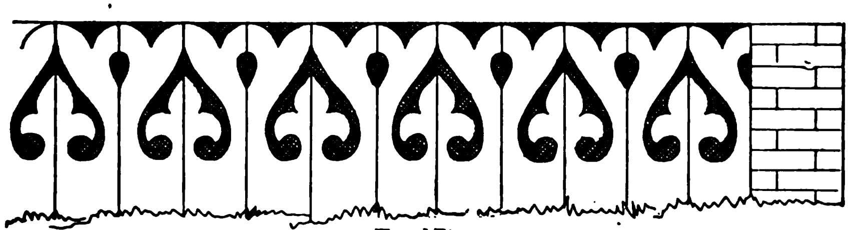


FIG. 19.

The piers should be very substantial, 18 inches square if of rubble stone or 12 by 12 if of brick. The 8 by 12 or 8 by 8 brick piers commonly used begin to bend in a few years. Wooden posts may with advantage and economy in many cases be made of spruce lumber creosoted by the Hayford process. This is done by the Hayford Wood Preserving Company, in Boston or New York, and the timbers so treated are more durable and reliable than cedar or locust. If distance renders it impracticable to obtain these, posts of red cedar or locust wood, or even white cedar and chestnut, may be used, but the best of them rot in the course of years, and the frost lifts them readily, so that such supports are generally the dearest in the end.

In iron districts refuse lengths of cast iron pipe are sometimes used

for posts with very good results. The corrosion is slow, especially if the posts are well painted and the ground does not freeze to them, so that buildings so supported are unaffected by frost. In any but the hardest soils a good sized flat stone should be set for the pipe to stand upon.

Whatever kind of basement is adopted, ample openings for ventilation should be provided. It is true that a well aired cellar, unless there is a furnace in it, makes it necessary to plaster the cellar ceiling or to lay the upper floors double, to prevent them from being intolerably cold in winter; but this is only part of the price which must be paid for a wholesome and enduring structure.

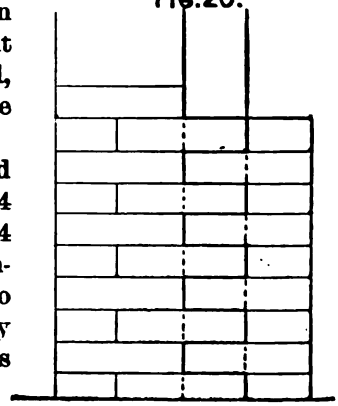
The walls above the basement will be of brick, stone, or wood, according to circumstances.

Solid brick walls of the required height may be 12 or even 8 inches thick, and must be furred with wooden strips 1 by 2 inches, nailed to the inside, and these strips lathed and plastered, the air spaces thus formed between the plastering and the inner surface of the wall being necessary to keep external dampness from penetrating into the room. Stone walls must be at least 16 inches thick, and the roughness of their inner surface rendering it impossible to nail furring strips to them independent studding must be set up inside, precisely as in the case of a frame building, and this lathed and plastered.

The concealed flues of combustible material thus formed, extending from cellar to roof, conduct sparks and flame in a few moments from any portion of the building to every other, without the possibility of discovering or arresting it in transit. Hence it is that the so called stone or brick buildings in which a fire kindled in the basement is likely at any moment to run up behind the furring and break out in the roof are in many respects more dangerous than frame structures.

Attempts have been made to make walls of masonry impervious to moisture from without by covering them with paint or cement, so as to obviate the necessity for furring, but it is found that such impervious walls condense the moisture of the room on their inner surface to an inconvenient and unwholesome extent. The only effectual remedy for these evils lies in the use of hollow walls, of brick throughout or with stone facing, as may be preferred, and such walls are by far the best to inclose school rooms.

FIG. 20.



Such a wall, of the height proposed, should be 16 inches thick, the air space being 4 inches, the outer wall 8, and lining wall 4 inches, and tied by continuous "withs" at intervals of about 2 feet. Each "with" is to be built with headers bonded alternately into the outer and inner walls. The corners should be built solid. (Fig. 20.)

The outer wall should be of the hardest bricks, the semi-vitrification of the surface being very necessary to prevent the conduction of water from the outside into the lining wall.

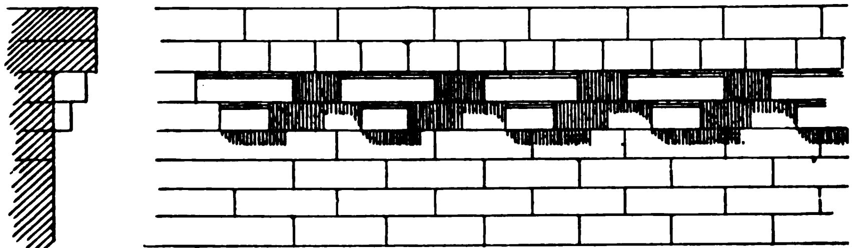


FIG. 21.

The inside of the air space should be made reasonably smooth, leaving holes at the bottom to facilitate cleaning out, and at the completion of the wall all mortar and shavings, remnants of hard-boiled eggs, bread crusts,

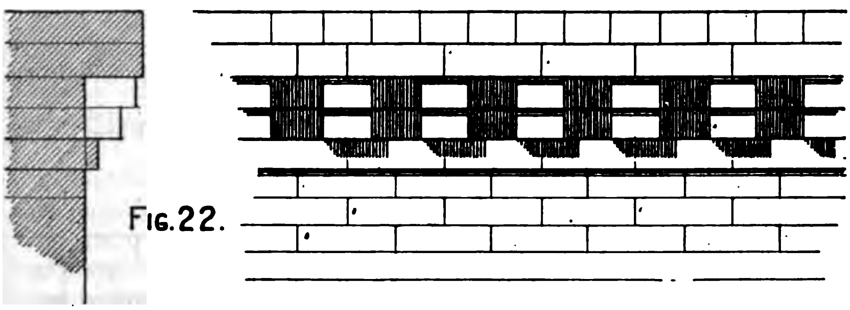
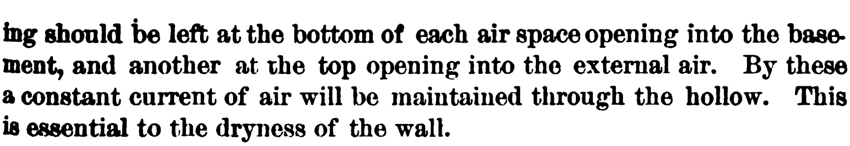


FIG. 22.

and other vestiges of the workmen's presence should be cleared out and the holes built up. At the cornice the air space will be covered over and a level bed of mortar spread for bedding the plate. A small open-

FIG. 23.



ing should be left at the bottom of each air space opening into the basement, and another at the top opening into the external air. By these a constant current of air will be maintained through the hollow. This is essential to the dryness of the wall.

It is best to build $\frac{7}{8}$ or $\frac{3}{4}$ inch iron bolts into the solid work at the corners to secure the plate. These should be 2 feet long and have a washer 2 by 4 inches or so at the bottom, and must be so set that 4 or $4\frac{1}{2}$ inches of the upper end will project above the top of the wall. This end has

a screw thread cut on it, and corresponding holes are bored in the plate, so that when this is laid on the ends of the bolts will appear above the

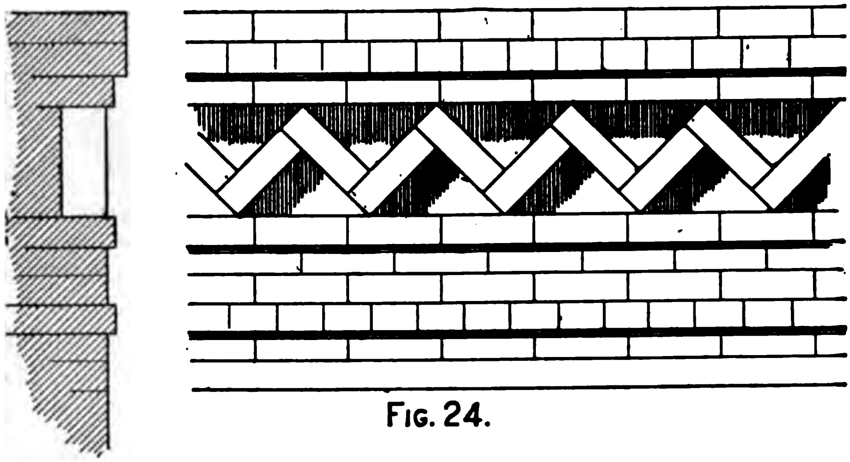
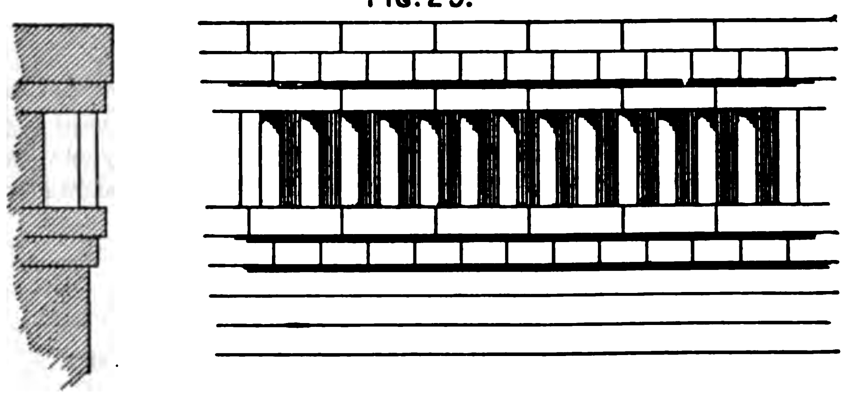


FIG. 24.

upper surface, and washers and nuts are then applied and screwed down. By this means the roof is firmly held to the walls.

Simple cornices may be formed by projecting bricks, as in Figs. 21, 22, 23, 24, 25.

FIG. 25.



In such buildings as we are considering a considerable saving of expense is made and a picturesque effect obtained outside, as well as great advantages for lighting and ventilation inside, by carrying the window openings up to the under side of the wall plate without arch or lintel, as shown in the figures below.

A cornice of brick may be made, if desired, stopping at the window openings, as in Fig. 26, but the effect will be quite as good, especially if common bricks are used, to finish the wall without any projection, and mould or cut the edge of the plate, either on the solid or by planting on mill mouldings. The former is much the better way. A boy with a

hatchet can hack the square edge of the timber into a "dog-tooth" ornament which will be sufficiently picturesque (Fig. 31).

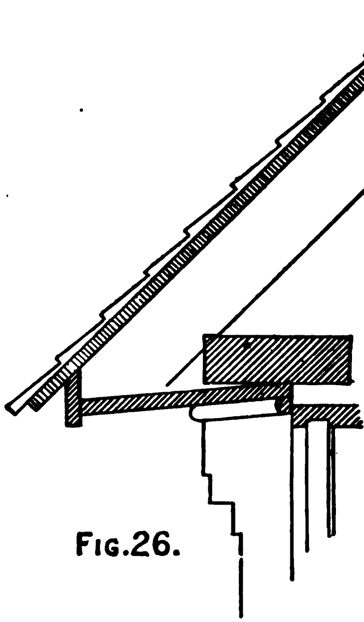
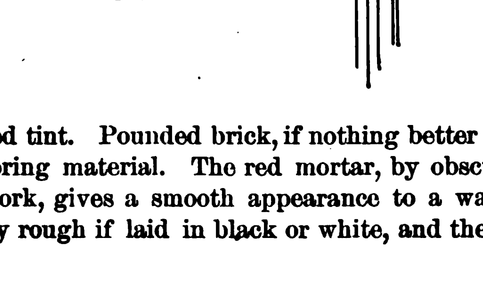


FIG. 26.

In country buildings it is quite possible with the aid of red mortar to make a good looking exterior wall of common hard bricks, instead of using face brick, the cost of which is from two to six times that of the others. The mortar is to be colored with Venetian red or any similar red ochre or mineral paint, which is added in sufficient quantity to produce the desired tint. Pounded brick, if nothing better can be had, will serve as a coloring material. The red mortar, by obscuring the joints of the brickwork, gives a smooth appearance to a wall which would look intolerably rough if laid in black or white, and the variety in tint

FIG. 27.



of common bricks gives to a wall built of them in this manner a picturesque play of color.

The bond can also be used to give a simple but pleasant decoration to the wall by means of the darker color which the headers should have.

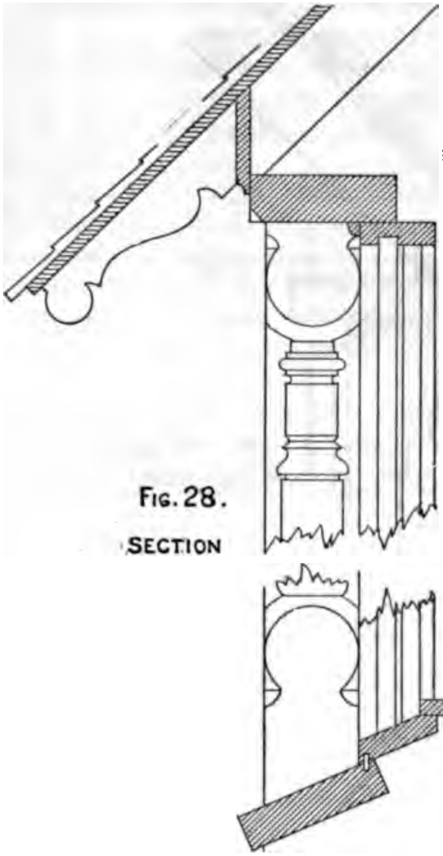


Fig. 28.
SECTION

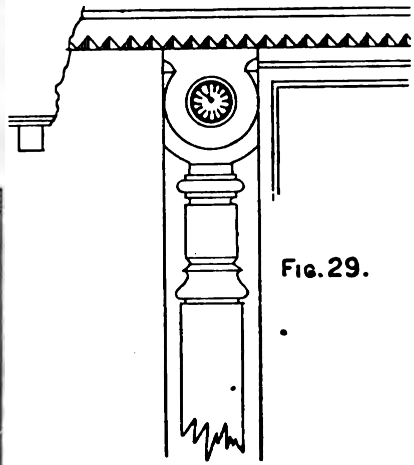


Fig. 29.

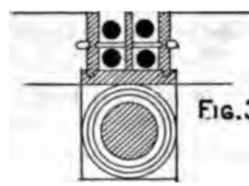


Fig. 30.

Owing to the way in which bricks lie in the kiln, the ends or heads are burned more than the sides, and as it is particularly important that the bonding bricks in one wall, which show their ends in the exterior, should be well burnt, those which possess the requisite hardness will have their heads burned to a dark red, blue, or black shade.

The ordinary bond for an 8-inch wall, which consists of a continuous row of headers every fifth or seventh course, will then give the wall the appearance of being barred with faint horizontal lines 10 or 15 inches apart. (Fig. 32.)

Flemish bond consists of alternate headers and stretchers in each course (Fig. 33), and different arrangements can be made, a variety of which may be used in the same building. (Figs. 34, 35, 36.)

The inside face of the hollow wall may be treated either by plastering

it, which may be necessary if the bricks are poor or rough, or what is better by laying the brick work of the lining wall neatly and leaving it exposed. With the cheaper kinds of face brick quite a beautiful

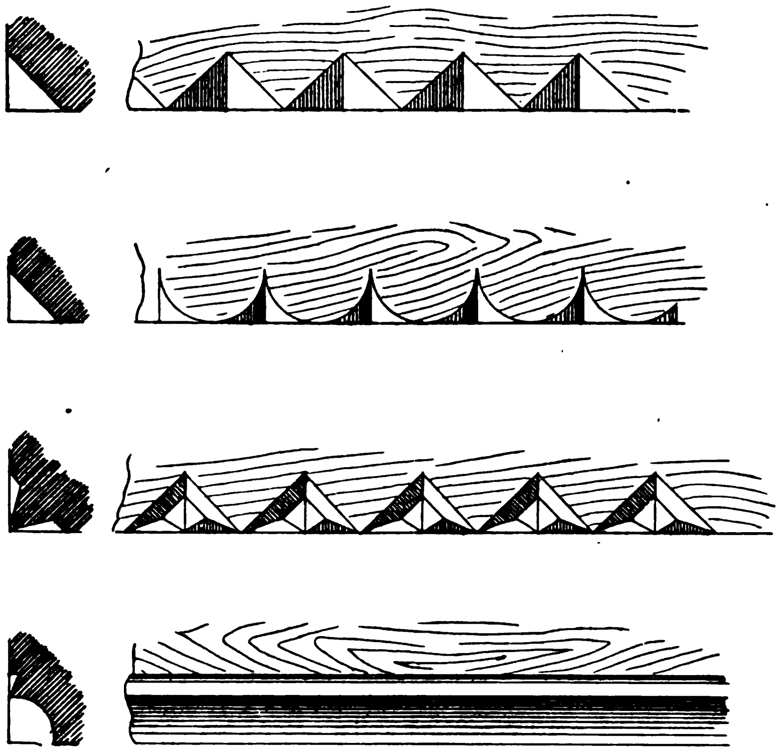
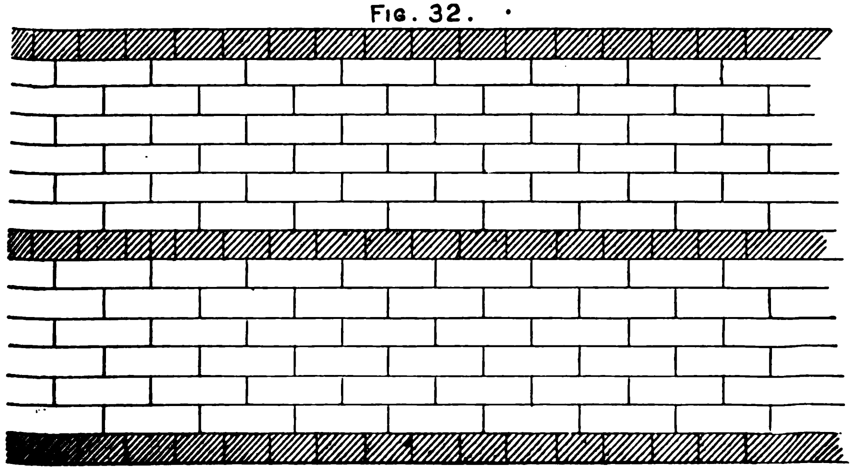


FIG. 31.

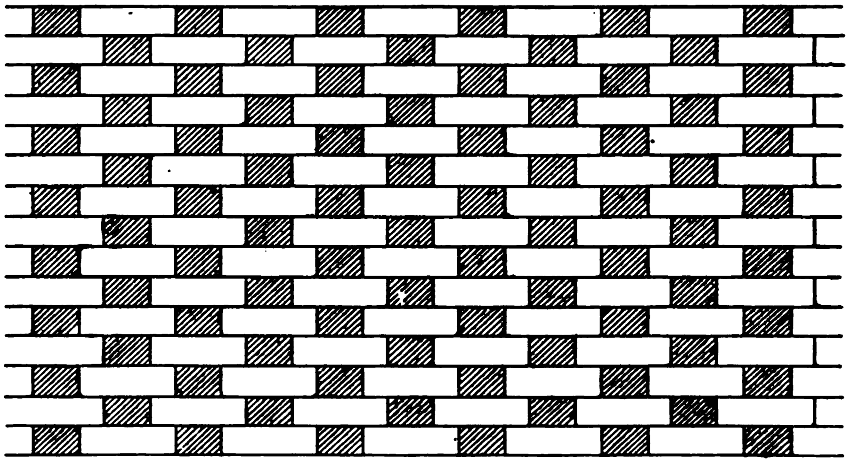
effect may be obtained, and even common hard brick, if selected with care and laid in red mortar, will make a much neater wall than might

FIG. 32.



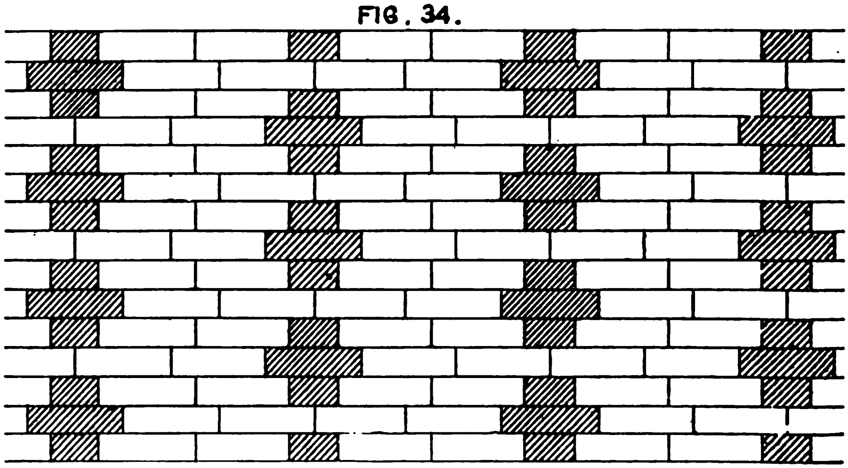
be supposed, especially if helped out with a course or two of moulded bricks near the top, to form an interior cornice. (Figs. 37, 38, 39, 40.)

FIG. 33.



A great variety of patterns of these are made and each being 8 inches long the number of any particular pattern wanted can be easily calculated. They are sent as freight, packed with hay in barrels, in any

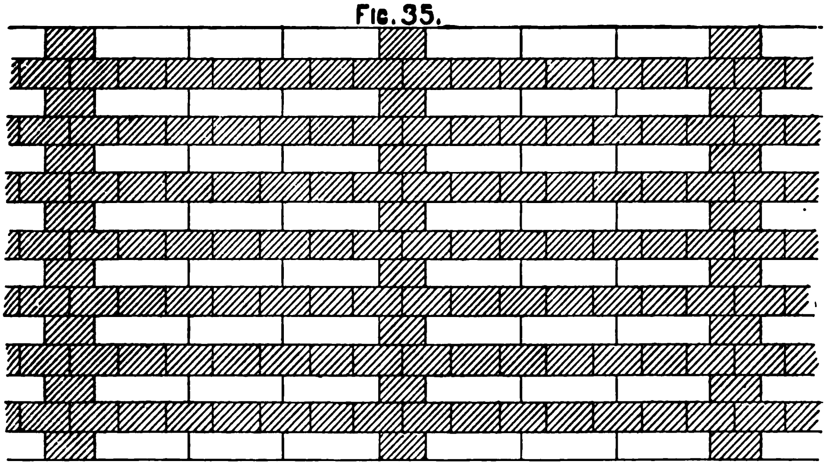
FIG. 34.



number desired, from 10 to 10,000, at 4 or 5 cents each, and form a cheap, durable, and beautiful means of decoration. They are made in Philadelphia (Peerless Brick Company), in Brooklyn, N. Y., and several other places, of red clay, and white ones are made of fire clay by Sayre & Fisher, Sayreville, N. J., and at Clark's Terra Cotta Works, Ottawa, Canada, and Glen's Falls, N. Y.

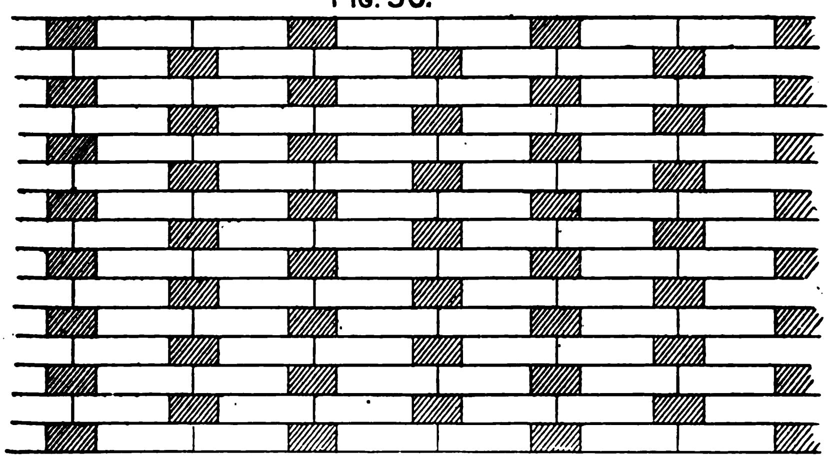
The lower part of the wall will be protected from rubbing by a wainscoting of wood.

FIG. 35.



The blackboards should properly be slabs of rubbed slate, secured with iron holdfasts to the brickwork, or the blackboard space may be plastered with cement and covered with the ordinary coating of so called

FIG. 36.



"liquid slating," which will make an infinitely better board on such a foundation than on the usual lathing covered with soft lime plaster.

Nothing can be more picturesque and pleasant in color to the eyes than such a wall, in place of the usual cracked and grimy plastering, and the bare brickwork has the important advantage of giving the freest possible circulation of air through the wall itself.

In constructing the ceiling it is desirable to avoid the ordinary light fabric of small timbers and laths, which in case of fire burns rapidly

and falls in. It is quite possible to build with little more expense a roof and ceiling which will burn slowly, if at all, and will not fall for

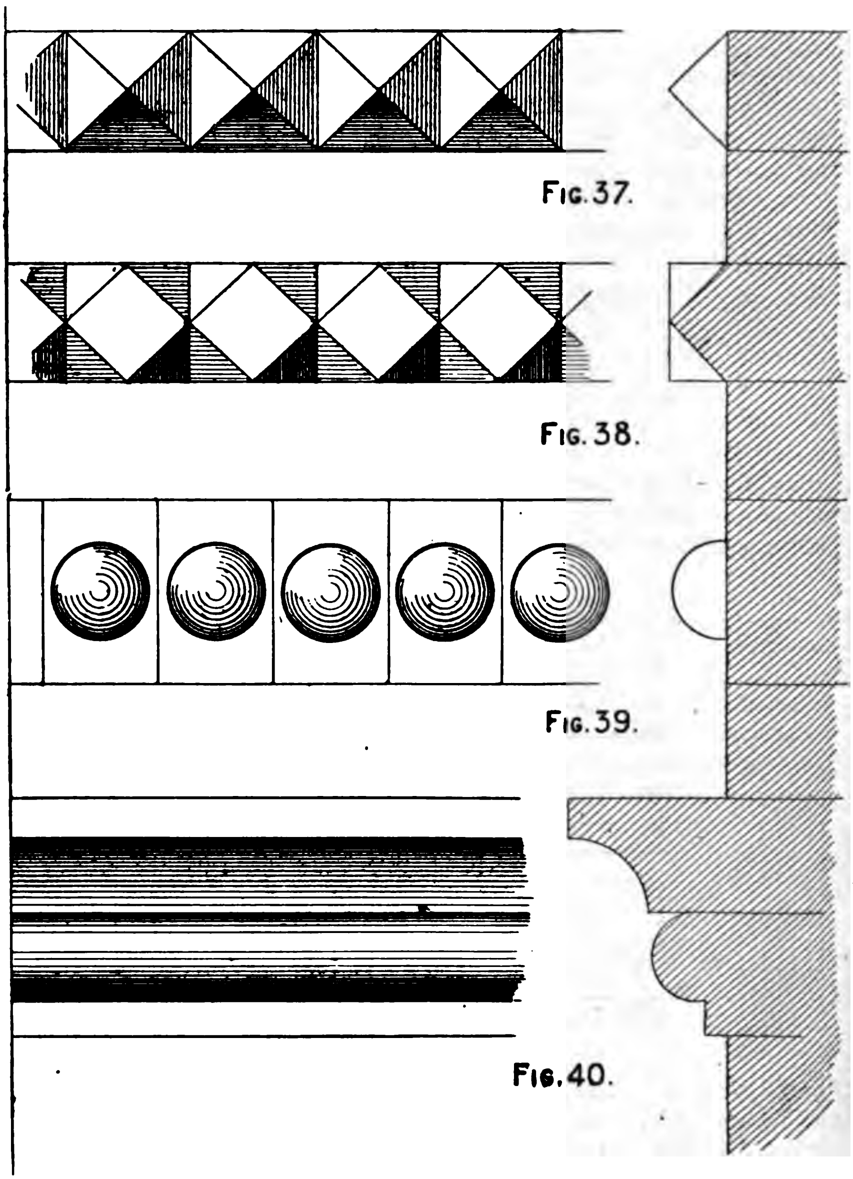


FIG. 37.

FIG. 38.

FIG. 39.

FIG. 40.

hours after they begin to blaze, giving time for the quiet removal of the pupils, their books and clothes, in place of the wild terror and confusion excited by the hay-stack-like conflagration of the usual mass of kindling wood which fills school-house attics.

The general principle to be observed is to support roof and ceiling by

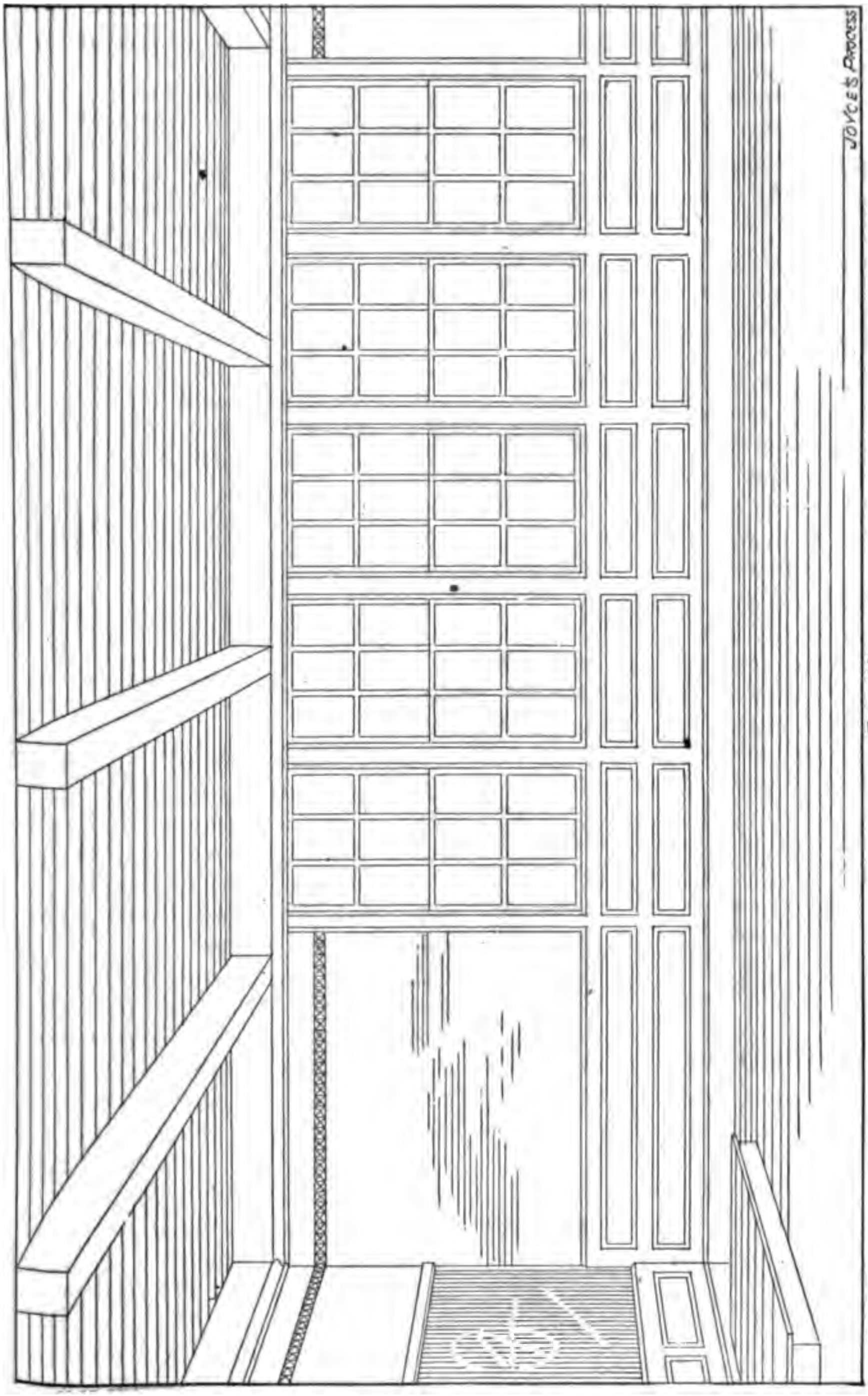


FIG. 41.

a few large timbers, rather than a multitude of small ones. This mı be applied as circumstances may direct. If, for instance, instead oi by 6 rafters, 20 inches from centres, supporting inch boards, the rafters were made 6 by 8, 8 feet on centres, and covered with 2-inch or better 3-inch plank, the amount of stock and labor taken together in the roof would not be very greatly increased, while the latter construction would resist fire for hours after a light ordinary roof had fallen into a heap of cinders.

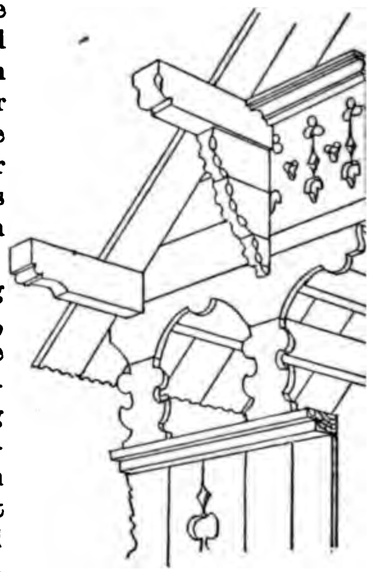


FIG. 42.

Ceilings also, instead of being hung from the rafters, should be independent, supported by thick beams crossing the room, and furred with strips underneath. If the expense of wire lathing can be incurred, a nearly fire proof ceiling can be made; if not, at least it can be made secure against falling all at once. By laying 2 or 3 inch matched planks on these large ceiling beams a still better ceiling may be made, which can be lathed and plastered beneath or even neatly finished and whi washed or painted, while the upp side may form a flat roof. The thic ness of the plank covering prever to a great extent the heating of t room by the sun in summer and kee out the cold in winter.

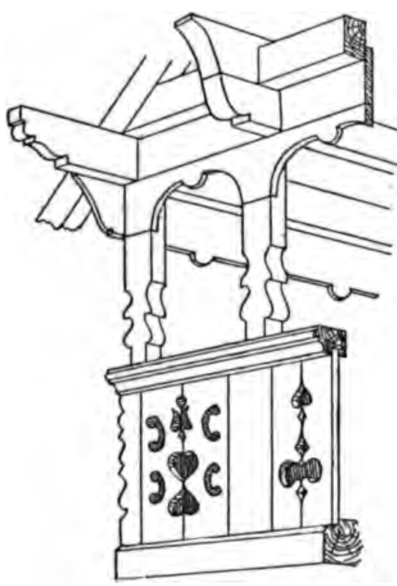


FIG. 43

Floors, if inflammable material stored in the basement, may wi advantage be similarly constructe heavy beams, 6 or 8 feet apart, bei covered with matched 3-inch plank

Little need be said about the roofi material. There is a fashion th brick buildings should have sla roofs, but it is only fashion. Ma brick and stone structures are no roofed with shingles on account the cheapness and tightness of su roofs, which remain perfect until t shingles rot, while the repairs on ordinary slate roof begin on the day the slaters leave it.

A slate roof is, however, often a matter of necessity, and it is worth remembering that by laying each slate in a bed of cement, spread on the upper part of the slates below, the roof is very much improved. The cement keeps the slates from rattling in the wind, the chief cause of their destruction, and is itself so protected that it can never wash out.

Metallic shingles, made in New York by the Iron-clad Manufacturing Company, form a tight and durable roof, at an expense not much greater than slate.

Flat roofs may be covered with tin, felt, tar, and gravel, felt, asphalt, and gravel, or, best of all, asphalted felt overlaid with thick slate, tile, or brick, bedded in warm asphalt. This is not much more expensive than the others, if slate or tile is accessible, and remains perfectly fire proof and water proof indefinitely. The flat roof is not objectionable in appearance, as may be judged from the sketches shown hereafter.

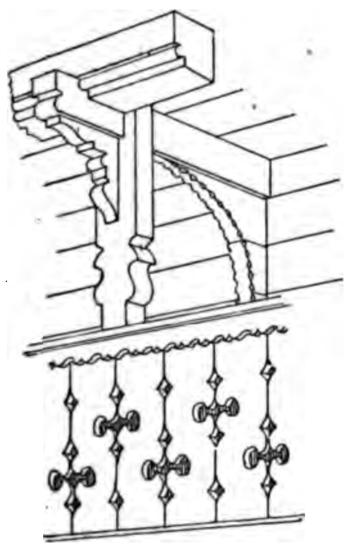
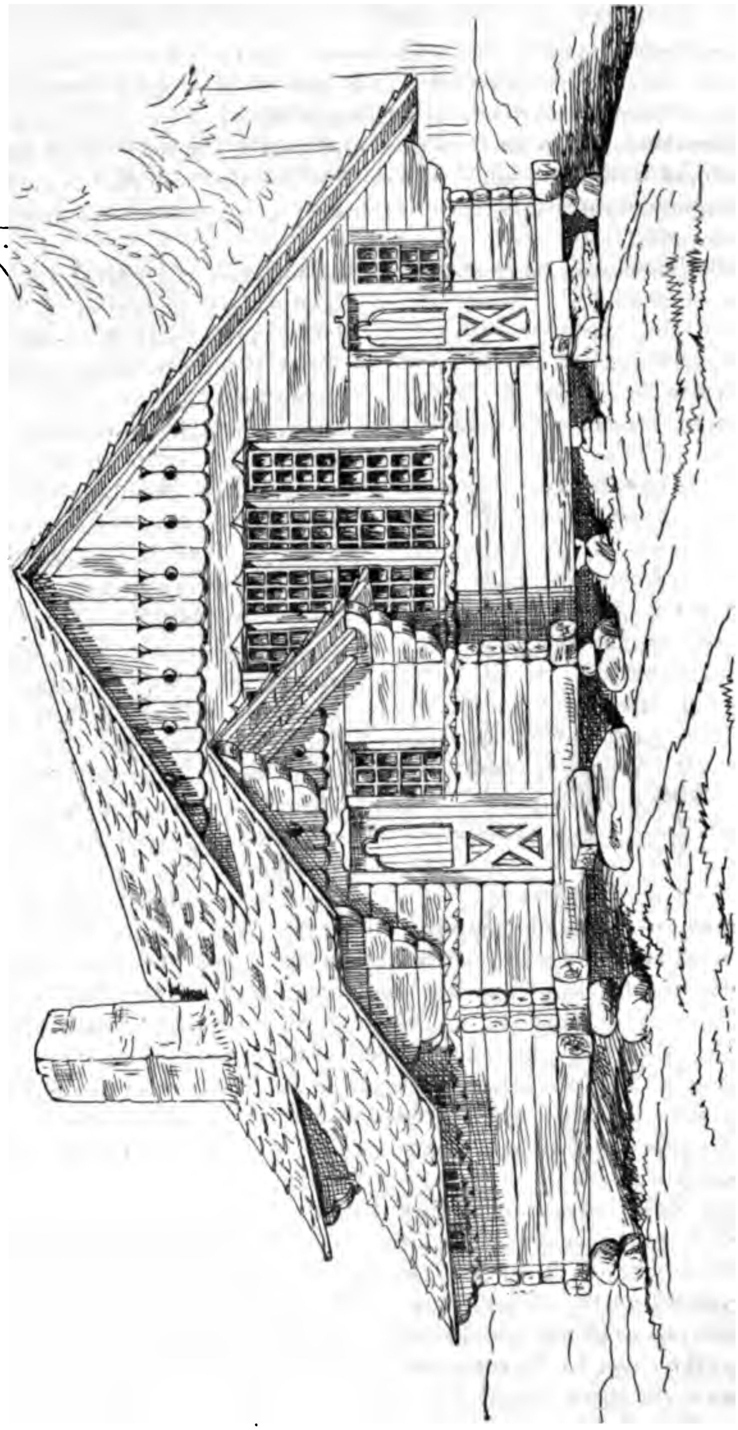


FIG. 44.

Next to a building of masonry, the most comfortable and substantial houses are those of logs. A good log wall, well chinked, is far more impervious to wind than the construction of studs and siding boards through which the winter winds whistle freely, resisted only by a layer of brown paper or imperfect "back plastering," and, rough as the log houses are commonly supposed to be, this mode of building is capable of most beautiful and picturesque forms. Figs. 42, 43, and 44 are from Swiss châlets, which are log houses pure and simple, with the sole addition of a little care in squaring the logs or planks neatly and a little fancy in cutting the ends, which are left projecting, into grotesque shapes. Many a southern or western log house is as neatly built, and only the suggestion will be needed to enable an ingenious workman to invent endless picturesque devices, which a spare day or two will suffice to carry into effect.

The Swiss carpenters fit their timbers beforehand so accurately that when brought on the ground they "come together" without the aid of nails or spikes. Even the rafters hold on the plate by simple notching, small purlins or laths are notched to them, and large shingles, or rather pieces of slabs and boards, are laid on top with considerable lap from the eaves to the top; and, to keep these down, poles are placed on them every three or four feet and heavy stones laid on the ends of the poles, the whole structure being thus often finished without a single nail.

FIG. 45.



They have little wind in their valleys; probably we should be compelled to nail our shingles, but we can imitate their neatness and lively taste.

Fig. 45 gives a suggestion for a school-house in the Swiss style, which any ingenious backwoodsman could carry out.

The common timber construction of studs covered with siding boards alone, or inner boarding and clapboards and shingles, is the poorest of all apologies for building; nevertheless, it is too common to be neglected, and if children cannot be sheltered by substantial masonry or logs at least the thinly covered frame of studs may be improved by following a few suggestions.

The sill, which should be 5 by 10 or 6 by 10, must be laid in a bed of mortar, spread on top of the foundation wall to receive it, and any irregularities in the top of the wall must be filled up with stone chips and mortar. In this way only can the wind be kept out from under the floor boards. The sill should be set on edge, as the portion next the foundation will gradually rot, and the margin for decay will thus be larger.

By painting the under side of the sill with a heavy coat of cheap paint before laying, its duration will, however, be greatly prolonged, the paint repelling the dampness of the foundation wall.

The floor beams are next laid, 16 inches apart from centres. Country carpenters, to save a few inches of siding boards, often notch the sill for the beams, and cut these with a projecting tenon 2 inches deep or so, at the upper edge, so that when this is laid in the notch the top of the beams is flush with that of the sill. By this arrangement, not only do the beams hang down below the sill so as to interfere with the foundation wall, to its and their detriment, but the tenon is very liable to split off, as Fig. 46 shows, dangerously weakening the floor.

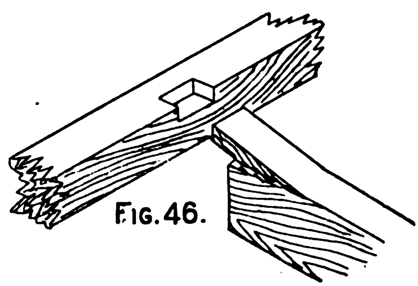


FIG. 46.

A much better way is not to mortise the sill at all, but to notch the beams to within 4 inches of the top, lay them in place, and spike them through the side. The 4-inch tenon will not split off, and the mortising of the sill, a great source of rot, is avoided. (Fig. 47.)

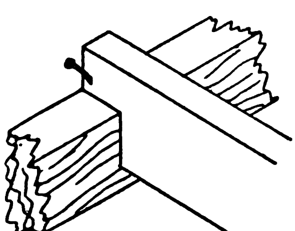


FIG. 47

If it is decided to employ the old fashioned or braced frame, as it is erroneously called (since the balloon frame admits of far better bracing), the posts will next be set up, mortised into the sill, the plate and braces, also mortised, put in place, and the tenons pinned, this skeleton being afterwards filled in with ordinary studs.

For a balloon frame all the studs are set up at once, 16 inches apart,

one being generally set beside each beam and spiked to it and to the sill without mortising. Even the corner studs are not mortised, and consist simply of two common studs nailed together.

After all are in place and held plumb by stay laths at intervals nailed diagonally to the studs and to the beams, and a few siding boards put on, the upper ends are sawed off level and the plate laid on top of the studs. Usually the plate consists of two studs, laid one above the other, the first being spiked through into the ends of the studs and the second spiked to the first.

The upright studs may be spliced by cutting the ends of the pieces square and "fishing" them with pieces of board nailed on each side.

When the siding boards and laths are on, the joint is inclosed in a box, from which it cannot escape.

By each side of doors and large windows two studs should be set and spiked together, to offer proper resistance to the slamming of the door or blinds, as well as to prevent any bending toward the unsupported side.

The bracing of a balloon frame is the most important part; without it, such a frame deserves the abuse which conservative builders heap upon it. The great object is to secure long braces, reaching from sill to plate if possible, and at an angle with the vertical of as near 45° as may be. The best way, supposing the studding to be 2 by 5 or 3 by 4 inches, is to use 2 by 4 or 2 by 5 for the braces, and gain them 2 inches into the outside of the studding, so that the whole will be flush, then spike to every stud. Such bracing is independent of shrinkage, which soon opens a little play in the angles of the old fashioned frames. Inch boards are often used for bracing, instead of 2-inch joist, but should be well nailed to be effective.

After bracing, the walls are to be inclosed. This, in the cheapest houses, is done with planed boards 8 or 10 inches wide, the lower edge of each overlapping the top of the one below.

This is very little protection against cold or wet, and in all the better class of structures an inner skin is put on of cheap boards, usually planed one side to reduce them to a uniform thickness, without which the exterior finish could not be properly put on. This should be covered with two thicknesses of felt paper, and the clapboards or shingles put on over; without paper, a sun-warped clapboard or shingle may admit wind and drifting snow.

Contrary to the common idea, a shingle covering is tighter and warmer than clapboards and much more lasting, although not so finished in appearance.

Even where neat at first, the shingles shrink after painting, showing the fresh wood between, which gives a ragged look to the surface, and the dipping or painting the edges, which will prevent this, is expensive.

The interior of the studding is lathed and plastered. In cold climates

it is usual to back-plaster by nailing fillets to the sides of the studs or on the inside of the boarding and short pieces of lath to these, then plastering, pressing the mortar up to the sides of the studs as much as possible.

All this makes a construction as inflammable as any incendiary need desire. Something may be done to lessen its dangerous qualities by lathing with wire lath instead of wood, but this is expensive. A more effectual and cheaper mode is to lay five or six courses of cheap brick and mortar on top of the sill, between the studs, filling all around full of chips and mortar, repeating the process once or twice in the height of the wall, by nailing bits of board to the studs, laying pieces of joist upon them, and building up the brickwork on these.

The best of all, however, is to fill up the spaces between the studs entirely with blocks of perforated concrete. The concrete may be made with mortar, plaster of Paris, and cinders, but it will generally be much cheaper to get it ready made, as furnished by the Fire-proof Building Company, 21 Cortlandt street, New York, or 52 Lexington street, Baltimore, or J. J. Schillinger, 111 Broadway, New York, and doubtless by other parties. It is said that the roof, walls, and floors of such a structure can be thus made practically fire proof at an additional cost of about 10 per cent. over the unprotected construction, a trifling expense compared with the great advantage gained.

Roofs of frame buildings may be shingled and painted to give a certain brightness of effect. Mineral paints are the cheapest and are generally used. Venetian red, Rocky Mountain vermilion, Iron clad paint, Prince's metallic paint, Brandon brown, and many others cost from 2 to 4 cents a pound. Indian red is the most beautiful color, but if good is considerably more expensive than the others.

A different mode of inclosing is sometimes seen, in which vertical matched boards are nailed to sill and plate and to horizontal "interties" between, and the joints covered with battens. The battens must have the edges bevelled or rounded, or they will curl up and admit water, and it is well also to hollow out the back with a plane to assist it in hugging close to the joint (Figs. 48, 49, 50). For outbuildings with-

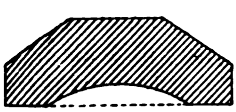


FIG. 48.

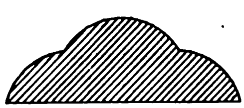


FIG. 49.

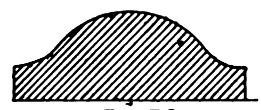


FIG. 50.

out plastering, where the studs can be 3 or 4 feet apart, this mode is economical, but in places where the studs must be set close for nailing laths it is neither weather tight nor cheap.

Interior finish is in such buildings not a complex matter. Upper floors should if possible be of Georgia pine, in narrow, matched strips, 4 inches wide or less, and well soaked with hot linseed oil when first

laid. This, if the applications are repeated until the wood refuses to imbibe more, will give a hard, polished, impervious surface, which can be easily washed and does not become filled with dirt like an ordinary floor.

Wainscoting and door and window trimmings are best of hard wood. Ash is generally used, being common and cheap. Chestnut is coarse in grain and soon gets a dirty look. White wood (basswood or tulipwood) is still cheaper, and, though not very hard, does tolerably well; it darkens very much with age, and should have the nail holes concealed as much as possible, otherwise the putty used to fill them up at first will, as the wood darkens, appear conspicuously light. Maple may be used if not too expensive. It is the best of all woods for floors, being particularly close grained. Butternut and black walnut are handsome but costly. All these woods need to be finished by the painter.

The simplest application is a coat of linseed oil, to bring out the grain, followed by one, two, or three coats of shellac varnish. This should be allowed to harden and then be rubbed down with fine emery cloth dipped in linseed oil. Oiling alone is sometimes thought sufficient, but, the pores not being filled, the wood gets black by handling. The pores of ash, chestnut, or black walnut are so large that shellac alone will not fill them, and they must first be rubbed over with a paste of oil, turpentine, and whiting or wax, or with "patent filler," so that the varnish may cover them smoothly.

Oak alone, of all woods, may be used without filling or painter's work of any kind, its naturally hard, glossy grain needing no help from varnishes. It must be carefully seasoned and used with understanding of its qualities, but so employed is one of the best finishing materials.

Soft woods must sometimes be used for finish, and may with advantage be oiled and varnished with shellac, like the hard woods. This will keep them from showing finger marks, as is inevitable where the woodwork is painted. After rubbing down, pine or spruce should have a light coat of shellac for a completing operation, to give a slight gloss.

Doors must be of soft wood, and such finishing will be very appropriate for them, where the standing finish is of harder material. In the more elaborate buildings, the pine doors are veneered with hard wood to match the other finish, but this adds to the expense. To make a solid hard wood door which will not warp is possible, but very difficult.

Wainscoting should be panelled. If made only 2 feet high, which is the proper height at the ends of the room where blackboards are to be set above it, with panels 12 inches high and 4 to 8 feet long, the cost will be very little greater than that of vertical matched sheathing and the effect in every way better. The joints of sheathing shrink unequally, even when half of them are not mere imitations, and the work begins to look ragged and cheap almost as soon as finished, while the seams afford harbor for insects. Under the windows the wainscot will look best to be the whole height from floor to window sill, 4 feet, but this may be

managed with two long panels, one above another, helped out by a bevelled baseboard. (Figs. 51. 52.) For very cheap work the panels may

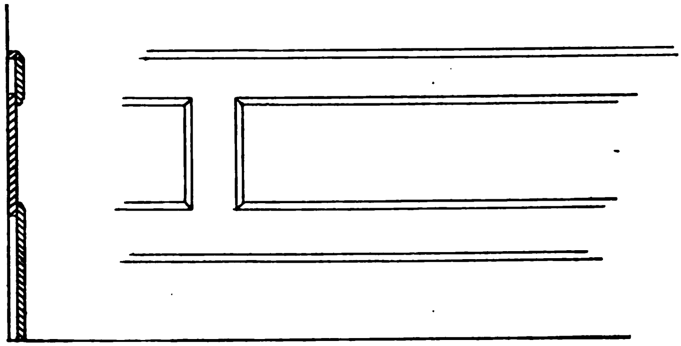


FIG. 51.

be $\frac{3}{8}$-inch boards nailed to the wall, and the framing or "stiles," also of $\frac{3}{8}$-inch pieces, neatly fitted and nailed on top. This is hardly to be

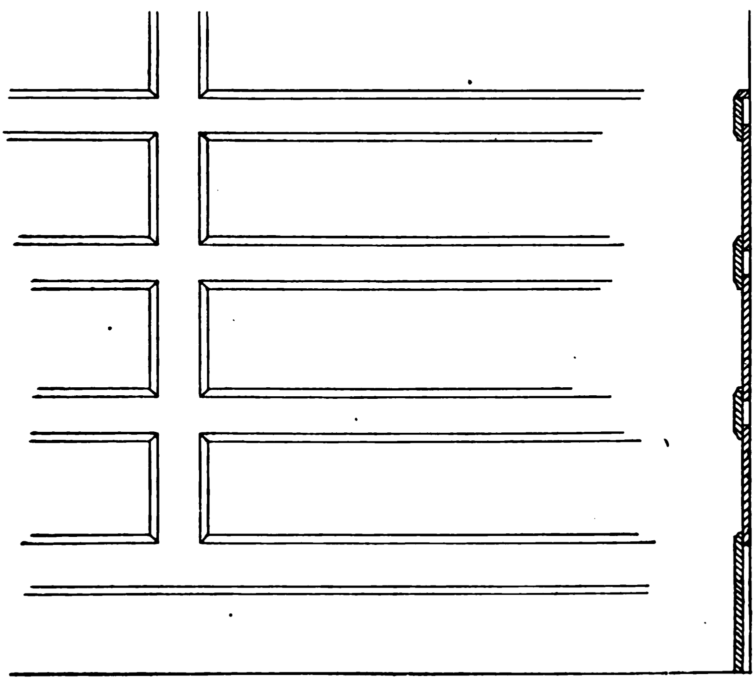


FIG. 52.

recommended, but it is better than matched sheathing. With hollow walls, when plastered on the brickwork or with the lining wall furred, $\frac{3}{4}$-inch strips, or grounds, are nailed on before plastering, by driving the nails into the joints of the masonry, and the finish is nailed to these.

Where the lining wall is exposed, grounds may be used, but it is be to fit the woodwork close against the brick, driving the nails into mortar joints directly or into wedges of wood previously forced into joints. In any case where woodwork is to be set against maso whether plastered or not, it is of very great advantage to give it a tl coat of paint on the back before putting it up.

FIG.53.

Wainscoting should be finished with a bevel or quarter round, which on the side walls may form a continuation of the stoolcap moulding of the windows. Under the blackboards it is common to finish with a moulding either shaped out of the solid into a trough on the top or supporting a separate one, which may be simply a strip of half-inch board, inclined toward the blackboard. This is to catch chalk dust and hold crayons and rubbers. (Figs. 53, 54.)

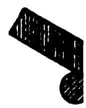


FIG.54.

Hallways and vestibules may with advantage als wainscoted in the same simple manner, 3 or 4 feet h

Door and window architraves are best very simple. Nothin better or neater in effect tha $\frac{7}{8}$ inch board, 4 or $4\frac{1}{2}$ inches w bevelled on each edge. The b may mitre around the top of w scot.

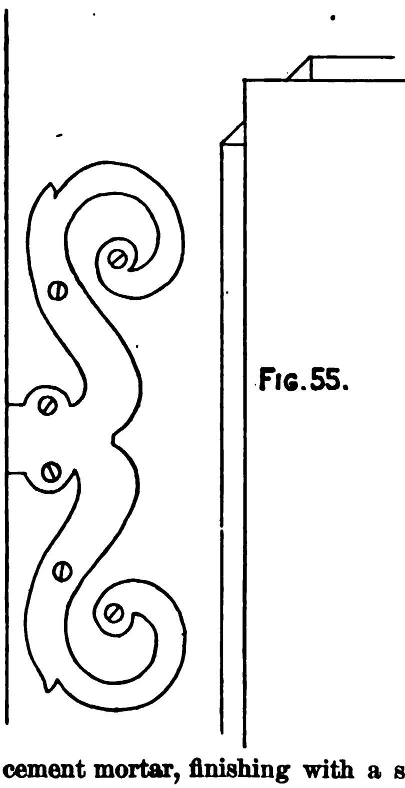


FIG.55.

When the finish comes against irregular surface of brickwork, stead of scribing the wood to outline of the brick, trouble ma saved by putting the wood on straight back and filling the in stice with plaster of Paris, col to match the bricks.

The best blackboards, and cheapest in the end, are of sl These can be had of any slate de three-quarters inch thick, w smooth rubbed surface, for 30 o cents a square foot. Such bo make little dust, are cleaned b sweep of the rubber, and are e lasting.

Among the inferior substitutes best is a brick wall plastered cement mortar, finishing with a surface of clear cement, rubbed d when hard with a flat stone and fine sand to a smooth surface, and t

coated with any good blackboard paint. Ordinary plastering, though commonly made use of, is very inferior.

It is best and cheapest to buy the blackboard paints put up in cans by the school furnishing houses under the name of "liquid slating," but an imitation may be made by dissolving gum shellac in very strong alcohol, 95 per cent. at least, and adding fine flour of emery, with lampblack, to the consistency of thin paint. Three coats must be applied. Occasionally the last coat of plastering is colored by adding lampblack, which must first be wet with alcohol or spirits, to enable it to be mixed with the mortar. When this is done it is well to add hydraulic cement to harden the surface. Blackboards may be finished with a small moulding at the top.

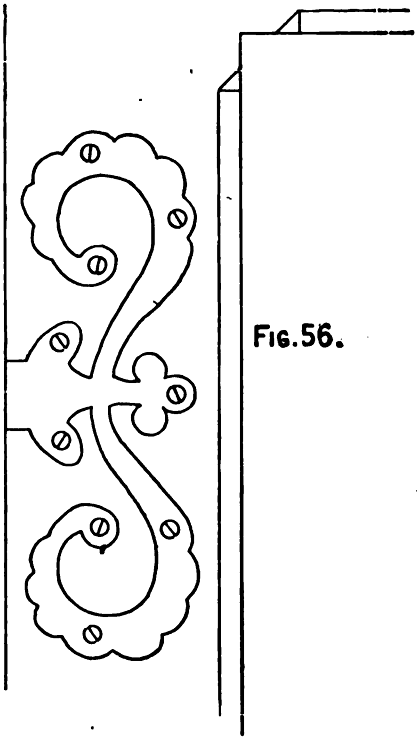


FIG. 56.

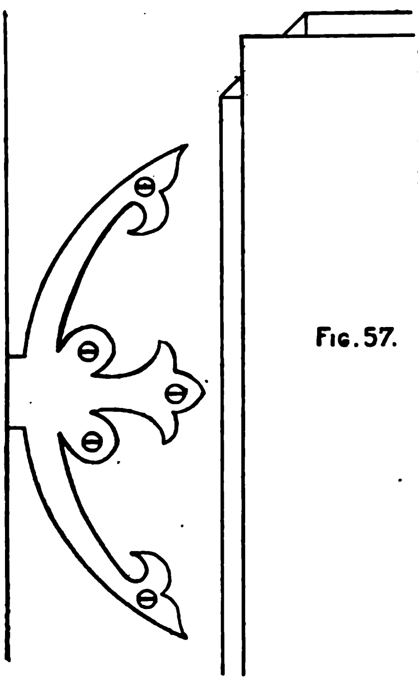


FIG. 57.

Doors may have a picturesque effect given them at small expense by the arrangement of the panels, and a small stopped chamfer on the framing looks well instead of mouldings and costs no more.

Windows should always be double hung, with good lines and weights, and accurately balanced, so as to move with a touch.

All doors should have locks, of good make, and knobs. Thumb latches, though cheap, will tear enough clothes in the first year to pay the extra cost of knobs ten times over. Butt hinges for hanging doors should be japanned, unless door and hinges are to be painted. A pretty effect may be given at small expense by having hinges made to spread out over the face of the door after the fashion of the ancient wrought iron

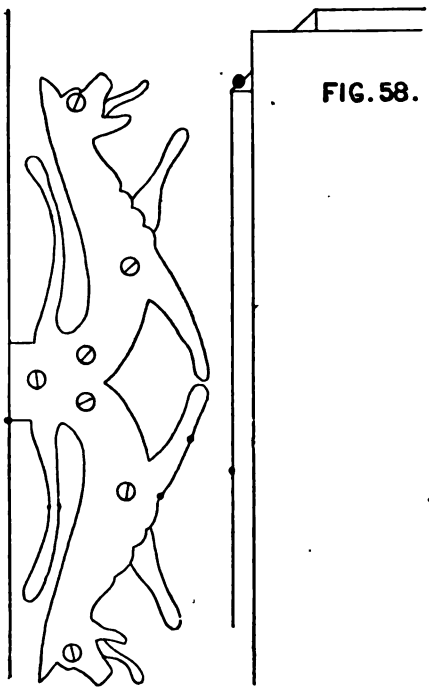


FIG. 58.

work. Some care is required in arranging butt hinges in this manner, so as to have the knuckle come right on both parts, and substitutes, or "shams," as they are justly called, are sometimes used, consisting of a thin plate of some fancy pattern, which is screwed on the door close to the hinge, which is itself an ordinary butt. The plates are thin, flat castings, japanned, with countersunk screw holes, and cost a mere trifle. The pattern is sawed out of thin wood, and the castings of "shams" cost but five or six cents each, all japanned. With knuckles for real hinges, drilled for the pin of the butt, the cost is 18 to 25 cents each. A few specimens are given (Figs. 55, 56, 57, 58, 59, 60).

VENTILATION.

It should be unnecessary at this late day to quote the well worn proofs that air loaded with organic contamination—"school room" air, to give it the specific name by which it is known in the text books of hygiene—is the great source of nervous disorders and depression of the physical powers, of tubercular diseases and consumption: every one knows them by heart. It is not, however, so generally known that children are many times more sensitive to atmospheric poison than adults, and that their natural brightness and activity during their school life, instead of showing that they endure its noxious influences with impunity, only conceal for the time the disorganization of lungs or nervous system which will assert itself when it is too late to remedy it.

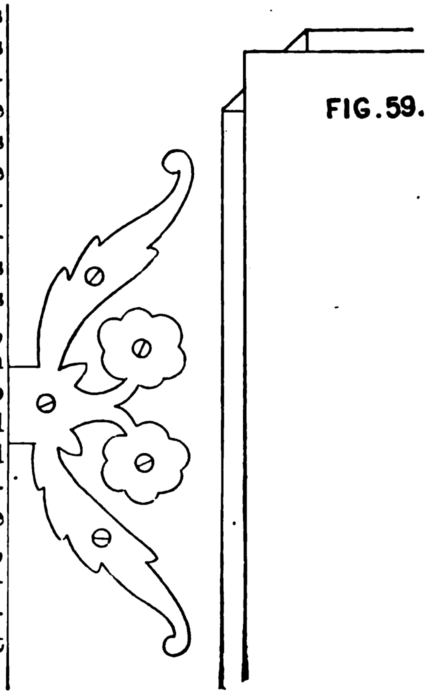


FIG. 59.

Those who control the construction of the large city school-houses are now generally awake to the importance of ventilation, and efforts are made to secure it, with some degree of success; but many country school buildings are not only wholly destitute of any provision for removing foul air, but, being warmed by stoves instead of the furnaces of the larger structures, no fresh air is admitted. Others have openings in walls or ceilings, wooden shafts perhaps, leading into the attic, but without fresh air inlets or means of persuading the foul air to pass through the openings provided for it; in few is there an intelligent comprehension of the end to be attained or adaptation of means to that end. Yet small school-houses are perhaps the easiest of all buildings to ventilate if the object to be secured and the dangers to be avoided are kept in mind.

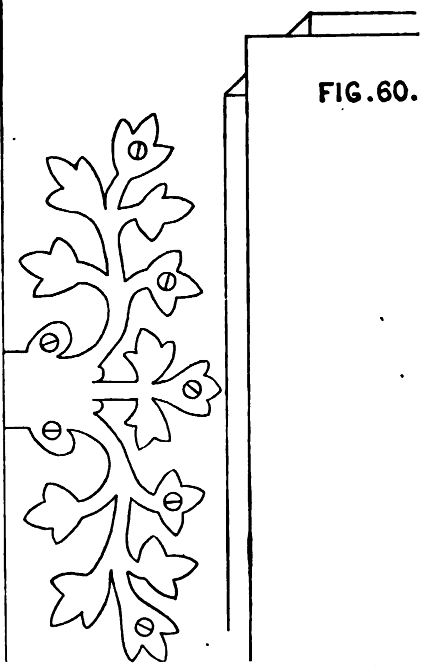


FIG. 60.

Briefly, the aim of ventilation should be to maintain a steady supply of fresh air and withdrawal of foul at all parts of the room, removing the products of respiration and organic particles as fast as thrown off and leaving no corners stagnant or unswept by the purifying current.

This is to be accomplished primarily by means of the windows, which must extend as near the ceiling as possible, so that the air entering by them may blow upon and carry away the organic dust and condensed vapor which collect upon its surface (when undisturbed) to putrefy and diffuse poison through the fresher currents below. The windows should be numerous and easily handled, so placed that by means of them a thorough draught can be immediately obtained, and, most important of all, they must be frequently opened. Nothing can take the place of aeration by means of open windows. Artificial ventilation, though required for changing the air when the windows are necessarily closed, is insufficient, even under the best of circumstances, unless the room is from time to time thoroughly refreshed and purified by the sweep of the free winds through all its windows widely opened. Such an atmospheric washing should be secured three or four times daily in all weathers; at recess, particularly, it should be insisted on, banishing teachers and pupils from the room meanwhile, if necessary. They will more than make up in the brightness of the remaining hours for the time they may thus lose. Immediately after school, morning and afternoon, the process should be

repeated for a longer time, and just before school, also, if the room can be warmed again quickly enough. No fixed transom lights or immovable arched heads should be permitted to exist over the windows, subtracting from the most useful portion of the opening; the large, heavy sashes common in the more pretentious buildings should be rehung with rawhide cord or copper chain if necessary and pulleys with friction rollers balanced so as to move with a touch, while in new buildings the size and weight of the sashes should be carefully kept down, no sash being over 3 feet wide or 1¾ inches thick. Eyes must be fixed to the upper sashes and a pole and hook furnished to handle them with, or, still better, cords fastened to each sash hanging within easy reach and pulleys to raise or lower them at will, and the window frames must be perfectly made, with cherry beads, and looked after from time to time to see that all is in working order.

Besides the general airings in which all the windows are thrown wide open it is possible and very desirable during three-fourths of the year to keep some of them partly open. If they extend to the ceiling, the upper part at least of the south windows, in rooms properly supplied with other fresh air inlets, may be pretty widely opened in the coldest weather without causing a noticeable draught. Such openings, if on the leeward side, often interfere with the action of extraction shafts by drawing to themselves the current of escaping air; but this is of no importance in the buildings we are considering.

There are times, however, when windows cannot be opened, and means must be provided for insuring the withdrawal of the respired air from the room in some other way.

For our simple structures, it is useless to consider the fan machinery for exhaustion and propulsion, by which the uniform passage of measured quantities of fresh air is secured. We must content ourselves with a means less scientific and reliable, but sufficient for our purposes: the extraction shaft, warmed or not, as the case may be.

The powers and properties of air shafts are often so grossly misunderstood that an explanation of their action may be necessary before proceeding to details. Nothing is more common and more absurd than to see rough ventilation flues, 4 by 8 inches, built in walls without any provision for heating them, under the supposition that they will "draw;" or to see tiny pipes, from the foulest places, introduced into chimneys which are cold half the time, in the expectation that the "forced draught" which is imagined to exist there will suck up and carry off deleterious vapor as fast as a square yard of filth can generate it. All talk of "forced ventilation" by means of a shaft without fans or steam jets is misleading. The action of every such shaft or chimney, warmed or not, is precisely analogous to the movement of two boys balanced on a see-saw. If their weight is equal, neither moves; if one is slightly heavier, he descends and the other ascends, but his motion

would not be fairly described by saying that he was "forced into the air." So with ventilating shafts; the column of air in them is balanced against a column of the same size and height outside of them. If the outer air is cold and that in the shaft warm, either from artificial heat or by communicating with a warm room, the latter column will be slightly lighter, because, being expanded, a given volume contains less weight. This difference of weight, if there is not too much friction in the chimney or elsewhere to be overcome, will incline the balance, and the air in the chimney will rise, cold air descending to take its place. The actual difference of weight between the column of air in a chimney 12 inches square and 30 feet high at a temperature of 100° Fahr. and an equivalent volume at 32° Fahr. would be 5 ounces; and this, deducting the friction of both the ascending and descending currents, will be the measure of the ascensive force of the air in the shaft.

Without artificial heat the ascensive power is much less—infinitesimal often; and in summer the current in a chimney is at least half the time reversed, the evaporation of the hygrometric dampness of the masonry cooling the air within it below the temperature of the surrounding atmosphere.

This force, feeble though it be, is all we have to depend upon, and it need hardly be said that all obstructions to its action must be avoided. The common cause of defective action is insufficient fresh air supply.

The movement of the balance depends wholly on the freedom of action of both its sides, and the heated column has no force to spare for sucking in cold air through inadequate openings to supply the place which it leaves; still less has it the power of going off by itself, leaving a vacuum behind; unless the cold air is ready in equal measure to supply its place, the warmer column will wait for it—in other words, stagnate—and there will be no draught. This is the condition of most existing ventilation flues nine-tenths of the year, as is easily shown by holding a light handkerchief before them.

Vice versa, if fresh air is to be introduced into a room, provision must be made for the escape of foul air. The simple experiment of attempting to blow into the mouth of a bottle will impress this fact upon the mind, and will show why it is that many rooms supplied with hot air from furnaces cannot be warmed until a window or other outlet is opened, allowing the pent up atmosphere to escape and the fresh supply to enter in its place.

In order, then, that there may be a flow of air through the room, not only must the withdrawing shaft be large, straight, and smooth, that the inevitable friction of the air upon its walls may not materially obstruct the outward flow, but the inlet openings must be also ample and unobstructed, any hindrance to the inward flow being equally a check to the outward current. To use a homely illustration, the room to be ventilated may be imagined to be traversed by the lower end of a huge

atmospheric roller towel. It makes no difference whether we pull one side down or the other side up to secure a movement; but if the towel is obstructed in any part of its course the whole is brought to a stand still. Recollecting also that to pull down a common roller towel actually takes more power than the whole force ordinarily available for moving the entire atmosphere of a large room, the total ascensive power of the usual ventilating shaft seldom exceeding one or two ounces, the imperative necessity for avoiding friction will be evident.

The principal means to this end is the enlargement of the shafts, the friction increasing only directly as the perimeter while the capacity increases as its square. For this reason a round shaft two feet in diameter will carry off about as much air as six shafts each one foot in diameter, and in square pipes the difference is still greater. Besides being large, the shaft must be straight, an elbow constituting a very serious obstruction; and it must be round or square, and as smooth as possible, to lessen the friction against its walls.

For the inlets the same precautions are necessary; but the task is easier, as they may be short. For the outlet or ascending side of the roller, a certain height is needful, as the force increases with the length of the warm column; but the descending side is formed of the whole outside air, and only tubing enough is necessary to introduce it into the room. It is, therefore, much easier to provide sufficient inlet than outlet. Inlets, however, have a difficulty of their own, that is, the necessity for avoiding cold currents or draughts from them, a difficulty not to be surmounted without considerable trouble. The best way is to introduce warm and cold air together through the same registers so as to temper the mixture in winter. How this can be best done under varying circumstances will be described in the following matter under the head of "Heating." We have now to determine the amount of air which should pass through the room in a given time, on which depend the size of the outlet and inlet pipes and subsequently the modes of inducing a current in these pipes, on which their efficiency depends.

The amount of fresh air which is allowed to hospital patients is about 2,500 cubic feet each per hour. Criminals in French prisons have to content themselves with 1,500 cubic feet per hour. Assuming that we care two-thirds as much for the health of our children as we do for that of our thieves and murderers, we will make them an allowance of 1,000 cubic feet each per hour. Forty-eight children will then need an hourly supply of 48,000 cubic feet. Definite provision must therefore be made for withdrawing this quantity of foul air. No matter how many inlets there may be, the fresh air will only enter as fast as the foul escapes, and this can only escape through ducts intended for that purpose, porous walls and crevices serving in cool weather only for inward flow. What, then, must be the size of the shaft to exhaust 48,000 cubic feet per hour? In shafts 2 feet or more in diameter the velocity of the cur-

rent varies with the height and with the difference in temperature between the atmosphere inside and that outside. In one 20 feet high, vertical, and smooth inside, with a difference in temperature of 20 degrees, the velocity will be about 2½ feet per second, or 9,000 feet per hour; that is, it will carry off 9,000 cubic feet of air per hour for every square foot of its sectional area. To convey 48,000 cubic feet it must have a sectional area of 5⅓ square feet.

Such a difference of temperature corresponds to that of the season when it is too warm to light the fire and too cold to open the windows, and for this season the ventilation should be adapted.

But in winter, the difference of temperature being much greater, the velocity will be increased, and the shaft, especially if warmed artificially, will exhaust more than is necessary, if the inlets will supply it. How is this to be provided for? The best way is to open the outlet shaft into the room by two registers, one near the floor and the other near the ceiling, the net opening of each register being equal to a little more than one-half the sectional area of the flue. If iron register fronts are employed, each one must be the whole size of the flue. The iron work occupying one-third of their area and the obstruction caused by the clinging of the air to the surfaces which it passes over deducting also from the effective opening, the net capacity of each register so used will be about half its superficies.

With this arrangement, opening both registers gives the full capacity of the flue for spring and autumn; in winter, partially or wholly closing the upper one reduces the capacity of the outlet in proportion to the acceleration of the current. The lower valve should be left always open; by this means, when the upper one is closed in cold weather, the greater ascensive force or draught at that season is utilized to draw downward from the ceiling the fresh warm air which issues from the furnace air chambers, and by virtue of its lightness accumulates at the top of the room, thus changing the whole atmosphere of the apartment and bringing the warmer layers down to where they are needed—about the bodies of the occupants. During the milder months, there is not power enough in the shaft to overcome the inertia of the upper strata of air in the room so far as to draw them down to the floor, and if only the lower valve is open, even though it be the full size of the shaft, they remain stagnant, the shaft supplying itself by a current which sweeps along the floor from the nearest inlet. By opening at such times the upper valve also, not only is the total capacity of extraction doubled, but the air is drawn from top and bottom at once, and thoroughly changed.

In hot weather the movement through the outlet shaft practically ceases; but at such times the buildings of which we treat will be ventilated by the windows. There are, however, many days in which the weather is not warm enough for open windows, yet the motion of the air in the "aspiration" shaft is too sluggish for effectual ventilation, even with both valves open. For such times artificial means of inducing a

current are valuable, as indeed they are at all seasons, for reënforcing the natural draught, feeble at best. When the thermometer in the shaft stands at 65° and out of doors at 0°, the difference of 65° represents an ascensive force or draught which, when the outer air stands at 50°, would require a temperature the whole height of the shaft of 115°, or rather more. To raise the air entering from the room at, say, 65° to anything near this temperature, which is not far from that of an ordinary smoke flue, evidently requires some artificial means. The simplest is to connect the actual smoke flue from the heating apparatus with the ventilation shaft. Then the air in the latter will be warmed by contact with the heated walls of the former. The two flues may be of brick, with a 4-inch with between, or the smoke flues may be of metal, carried up inside the air shaft. Riveted copper and cast iron pipes are used for this purpose, and even vitrified or terra cotta drainpipes may be employed. Of course, no assistance whatever is derived from these sources unless there is a fire in the furnace or stove with which the smoke pipe is connected, and, as was said above, the warmer the weather the less will be the natural draught and the hotter must be the fire built to aid it. This is inconvenient, although in the majority of cases it is the best arrangement practicable. A more manageable, but more costly, means of artificial aspiration consists in the maintenance of a special fire within the flue itself, either a grate full of coal or a gas or oil flame. Some such motive power is necessary when artificial ventilation is to be carried on through the summer; but to be of any use it must be widely different from the feeble flames which are so often imagined to be "forcing" a current through an air flue. In summer, with air outside and inside at the same point, to cause a withdrawal of 48,000 cubic feet of air per hour, the minimum allowance for a room containing 48 children, through a shaft 2¼ feet square inside, will require the consumption of not less than 20 feet of gas per hour. The cooler the season the greater will be the natural draught and the less gas will be needed; but an expenditure of half that amount is out of the question for school purposes, and less than this would be merely delusive. So with the steam coils which are often introduced: in the majority of cases the obstruction which their bulk presents to the current is at least equivalent to the assistance derived from their heating qualities.

A partial exception should be made in favor of a system of aspiration, applied by Mr. Henry A. Gouge, 47 Beekman street, New York, and covered by his patents, so that application must be made to him for license to use it. The principle on which this depends is illustrated by the following experiment: Blow through a small tube toward a candle flame at a distance; it will be feebly affected. Blow in the same manner through a larger tube; the effort will be dispersed and lost. Again, blow through both tubes, holding the end of the small one a little way within the other—experiment will show the proper distance—the candle will be strongly affected, the current through the lesser pipe seeming to

be reënforced by an induced current entering at the open end of the large one.

In applying this principle to the ventilation of rooms, the main extraction shaft of the size required is cut off at a certain point, leaving the lower end open. A smaller metal pipe, five or six inches square, is inserted a little way into this open end, and at the bottom of the small pipe is placed a lamp or gas-jet. The strong though slender current, produced by the flame burning in so confined a space, passing quickly upward into the mouth of the large shaft, induces in this shaft a movement of the air greater than would be effected by the same expenditure of fuel in the ordinary way.

Some one of these means of maintaining a current may be very useful under certain circumstances. In ordinary cases such quickening of the draught in the air shaft as is afforded by connecting it with the smoke-flue is, combined with thorough and frequent airing by open windows, all that can be attempted. There will be damp days in spring and autumn when this is ineffectual, but, if outlets and inlets are large enough and unobstructed, such days will not be numerous.

The shafts must, however, be tight to be of much use. The wooden ducts, so commonly employed, warp and crack, retarding the current by the escape and diffusion of the air. The upper register must also close tightly, or it will be impossible to draw the warm air down to the lower one for winter ventilation. Wooden sliding or hinged shutters can be made pretty close, but metal registers and valves are better. Those made by W. G. Creamer & Co., 96 John street, New York, have a lip on the valves, which assists tight closing.

Besides the ventilation of the school room proper, it is of great use to provide for the discharge of the intensely heated air which in summer collects under the roof. The general rule applies here, that without inlet there will be no outflow, so that two or more openings must be made. The most effectual plan is to construct an open ventilator at the highest part of the roof, and leave openings between the feet of the rafters all around. This effectually clears the roof space of hot air, the movement being stronger as the heat of the sun is greater. Another less thorough way consists in making openings, protected by blind-slats, at two points in the roof, in gables or dormers. If the wind is favorable, the air is by this means slowly changed.

Special ventilation is often needed for particular points, as wardrobes, water closets, &c. For these it is generally sufficient to bear in mind the rule that without both inlet and outlet of about equal capacity there will be no effective current; with them, the days are few in which there will not be some change of air, though it may be slow.

It is not absolutely necessary that the outlet shaft should be vertical. In some cases, where it is difficult to carry up a flue, tubes carried horizontally in two different directions to the outside of the building will

work well. The wind pressure being never the same at the mouth of both tubes, air will enter through one and flow out through the other.

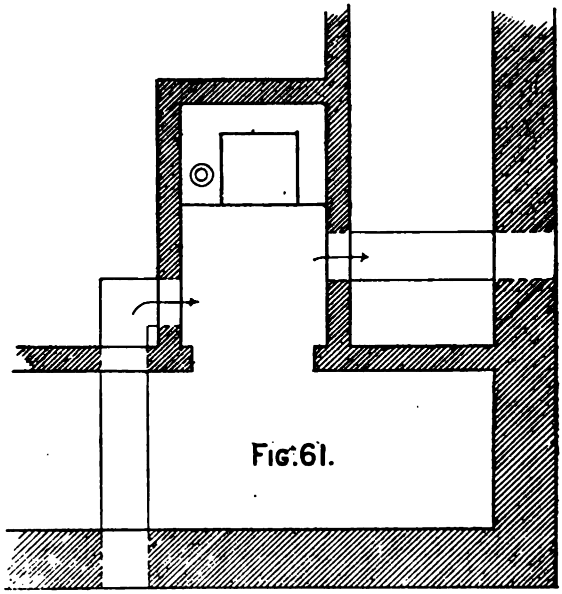


FIG. 61.

The ventilation of privy vaults is treated of below under "Sanitation."

It is a disputed point whether the galvanized iron caps, of which so many forms are sold, assist the action of ventilating flues. That they do not in practice accelerate the current is made certain by rigid tests of many varieties, but they do not materially obstruct it, and the best will generally but not always prevent down draughts where the flue is situated near a higher roof or a hill.

HEATING.

Shall the school room be heated by shutting out all fresh air, starting an air tight stove or a steam radiator, and parboiling the bodies and brains of the children in an unchanged atmosphere reeking with carbonic acid and organic exhalations? This will save fuel, but waste life. Fresh air must be admitted at any cost. How is the fresh air to be introduced, cold from the outside or warmed in transitu? If it enters cold, those nearest the inlet will suffer from the chilling draught. Unquestionably it must be warmed before it enters the room.

Then the problem of heating is solved; 48,000 cubic feet of fresh air per hour, the minimum allowance for a school of 48 children, must be raised from the out-of-door temperature to 70° and discharged into the room. Any heating apparatus which will do this is suitable, and none is suitable which will not.

In practice, heating stoves or furnaces raise a comparatively small

amount of air, that which actually comes in contact with their radiating surfaces, to a temperature of 100° to 200°, and this is subsequently mixed with a sufficient quantity of cool air to give an average atmosphere at 70°. There is nothing objectionable in this, provided the warmer component is not so heated as to char and decompose the dust floating in it, and provided also that the cool portion of the mixture is derived fresh from out of doors, and is not simply the foul air of the room, which has been cooled by stagnation, and, drifting near the furnace register, is caught up and sent into renewed circulation. This will be the case unless supplies both of hot and cold air are introduced together from out of doors in such a way that if the current from the register is too warm it may be tempered by increasing the proportion of fresh cold air in the mixture at the same time that the proportion of warm air is diminished; not, as is the ordinary arrangement, by shutting the register, and thus cutting off all supply of fresh air of any kind. With such a system, keeping the admission of fresh air the same at all times, regulating its temperature by varying the proportion of its two component parts, supplemented by suitable shafts for withdrawal of foul air, winter heating and ventilation are easily managed.

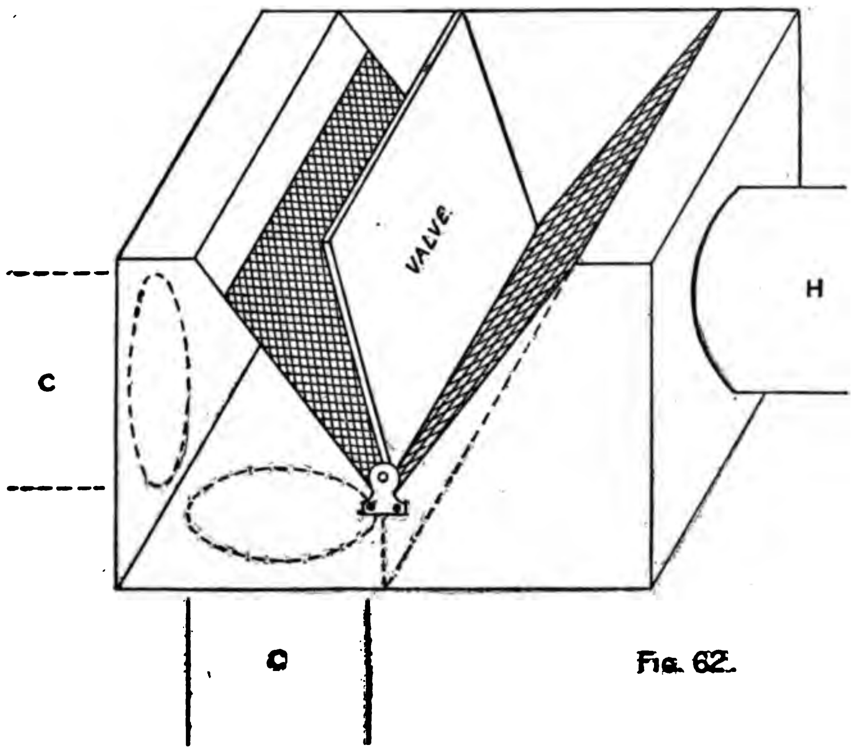


FIG. 62.

Fig. 62 shows a suitable device for effecting this mixture of warm and cold fresh air in the register box of an ordinary furnace, but there are many other ways.

The register box is shown in section: H is the usual tin pipe fro the hot air chamber of the furnace. C is a similar cold air pipe leadin from out of doors or from the cold air box of the furnace. The pipe may be introduced either below or at the side.

So far, there is no difference between this and an ordinary regist box. To apply the regulating valve, strips of tin are soldered to th sides of the box, with a low partition through the middle, and to th fixed partition is hinged a tin flap, stiffened by wiring the edges. Noth ing more is needed but to take out the valves of an ordinary regist and arrange the button by a short wire lever to act upon the flap.

To diffuse the hot and cold air, wire gauze may be put over the in clined mouth of each division and a sheet of the same may be sprea under the register plate itself. This will mix the two currents and preven unpleasant draughts, and the size of the registers may easily be mad larger to compensate for the obstruction to the flow so caused.

This disposition of registers is practicable with any form of basemen furnace. Where the room is warmed by stoves a different arrange ment is necessary, the principle of which was explained by Franklin century ago, and consists simply in bringing cold fresh air from out o doors by a duct which directs it against the radiating surface of th stove, from which it passes warmed into the room. An application o this principle may be made with any common stove by carrying a tin o wooden pipe from the outer air to a point beneath it, and directing i upward through a hole in the floor under the stove. A part will come i contact with the hot iron and be warmed, while the rest escapes un changed, but the whole will be pure. An improvement on this consist of a galvanized iron or zinc casing around the stove, by which the in coming air is held longer in contact with it and more thoroughly warme These, however, are wasteful make shifts. The "school stoves," of whic many kinds are manufactured, accomplish the same end far more econom ically and thoroughly.

Figure 63 shows the construction of that made by Mr. John Gro sius, 389 Main street, Cincinnati, Ohio, the direction of the pure ai from outside within the casing and on the hot surface to its escap through the open top being easily seen. It is in fact a small hot ai furnace. Similar ones are sold by the New England School Furnishin Company, Boston; A. Lotze's Sons, Cincinnati; L. W. Leeds, Ne York, and many other parties.

Another heater much used in schools is the so called Fire on th Hearth stove, made by the Open Stove Ventilating Company, 78 Beek man street, New York, which differs from the preceding mainly in havin an open front, so that it can be used either as an air tight stove or an ope fire. Where it can stand at a distance sufficient to prevent scorchin the faces of the scholars, the open fire quality is very desirable. Th radiation from the mass of coals warms the floor and the feet of th children in front, and the ventilation afforded by the draught of the fir

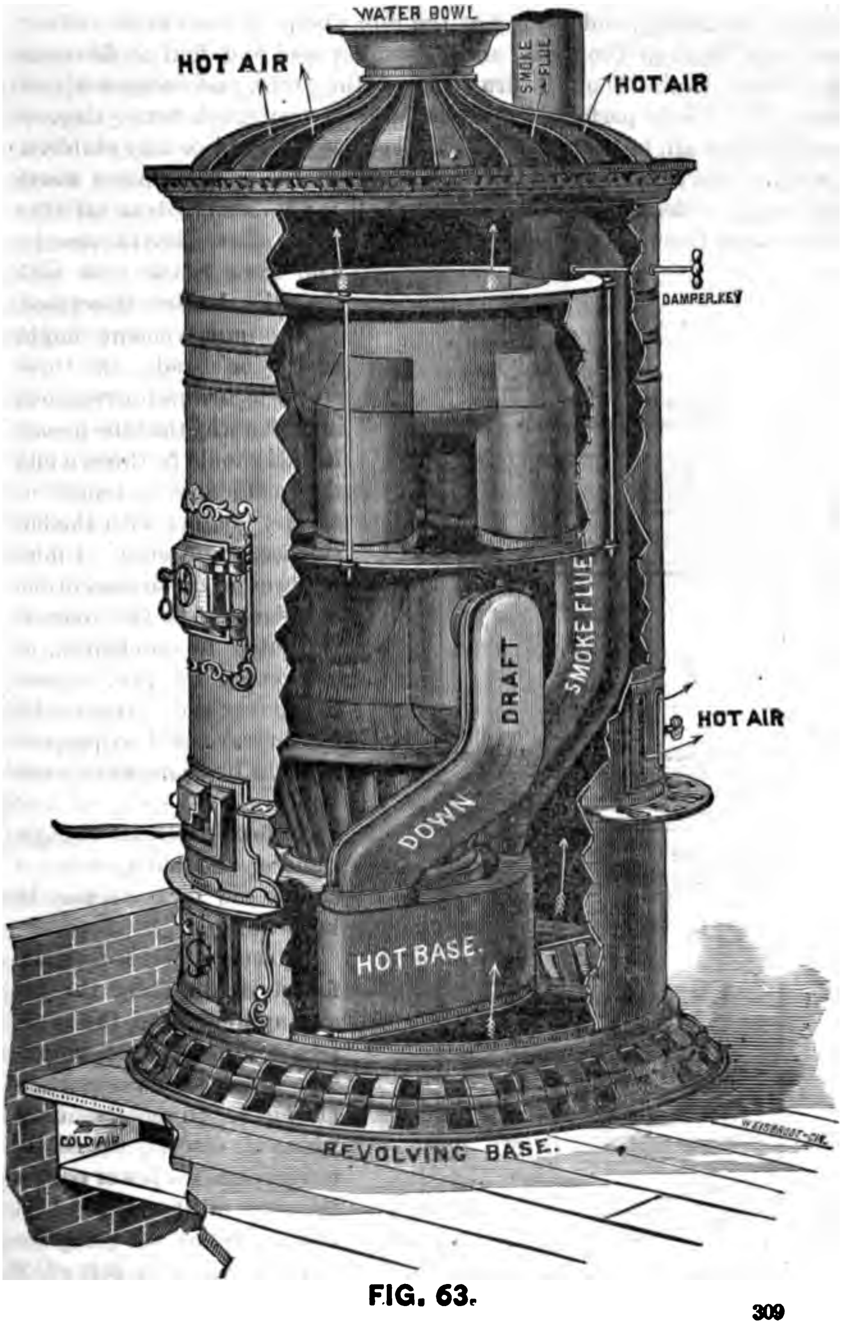
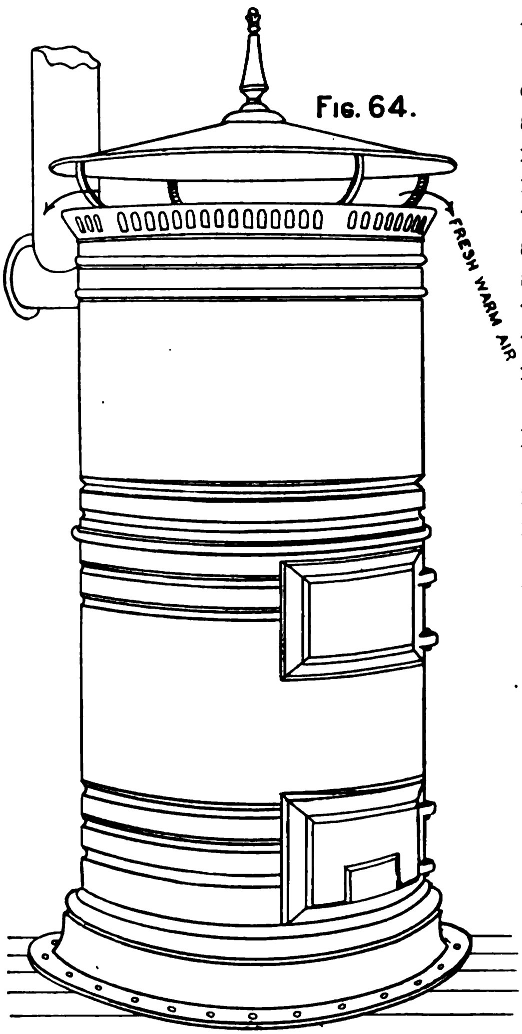

WATER BOWL
HOT AIR
SMOKE FLUE
HOT AIR
DAMPER KEY
SMOKE FLUE
DRAFT
DOWN
HOT AIR
HOT BASE.
COLD AIR
REVOLVING BASE.

FIG. 63.

is very considerable. Indeed, many small school-houses are warmed and ventilated wholly by means of one of these stoves with the front open, the fresh air supply entering beneath, being warmed in its passage through the casing, and issuing at the top, whence it rises to the ceiling, circulates through the room, and becoming cool and foul at the same time, settles to the floor, is drawn in at the grate, and escapes up the chimney. This is perfect in principle, and is very much better than no ventilation at all, but is inadequate to the needs of forty or fifty children. With the blower on and closed, this stove affords no ventilation worth mentioning, unless a separate exhaust shaft is provided to draw off after vitiation the fresh air which it furnishes, and thus allow more to come in. The same is the case with the other heaters described.

FIG. 64.



An improvement might easily be made in these stoves by arranging registers in such a way that the incoming air should be thrown into the room after a longer or shorter contact with the hot surface, at pleasure. Under the present arrangement the temperature of the room is regulated by quickening or slackening the fire, a comparatively slow process; by the improvement we propose it could be changed in a few minutes.

A few practical suggestions on the management of stoves and furnaces may be kept in mind.

Difficulty is sometimes found in directing the hot air supplied from the registers to the desired points. The school stoves, particularly in a high room, send the warm air directly up to the ceiling, and the lower part of the room must wait until the upper regions are completely filled before it can enjoy the heat. The Fire on the Hearth stove obviates this

difficulty to a great extent by its powerful draught, which immediately sets up a circulation from the upper strata to those nearest the floor, and a good ventilating shaft with the lower register only open accomplishes the same result; but a still more speedy effect may be obtained by suspending a shallow screen of sheet-metal over the stove, by which the ascending current is directed outward and downward so as to reach the occupants of the room at once, becoming also thoroughly intermingled with the general body of air. The Boston school stoves (Fig. 64) are made with this appendage, which can be easily added to any form of apparatus. Furnace registers often need similar screens to direct their current toward or away from any particular point.

It is much disputed whether furnace registers should be in walls or floor, or, if in the wall, at what height. For large buildings with strong ventilation the best position seems to be in the wall, 6 feet or so above the floor. Then the current warms to some extent the lower strata of the atmosphere of the room, without blowing directly upon any one, and the tendency of the hot air to collect at the ceiling is counteracted by the draught toward the lower register of the ventilating shaft.

Where the ventilation is as feeble as it will generally be without fans or special sources of heat in the shaft, this tendency of the hot current to rise out of reach cannot be overcome, and although the fresh warm air, like an inverted lake filling up from below, finally reaches the occupants of the room, much of its heat is wasted in warming the ceiling, so that for such cases, which include most small buildings, the best position for registers will be either low in the wall, and directed so that the strong horizontal current from them will not annoy any one, or in the floor, where the natural disposition of the air to rise is counteracted by its clinging to the floor, along which it travels horizontally a considerable distance before leaving it to ascend to the upper regions. Floor registers are liable to gather dust; they must be kept clean.

An inconvenient breeze from a register, either hot or cold, may be lessened without diminishing the supply of air, by widening the box or pipe in trumpet shape, with the mouth toward the exit, and putting on a larger register plate. Wire gauze either over or under the register will also do much to diffuse the current gently.

Furnaces should be set under the northwest corner of the building, and registers may be placed in the four angles; the greater length of pipe needed to reach the southern registers, and the consequent obstruction by friction, will be compensated by the natural circulation of the air in the room, upward on the sunny side and downward on the cold side, so that the delivery will be uniform at all the registers, which it will not be if the furnace is centrally placed. Stoves also heat more equally if set in the coldest corner.

Registers and the so called ventilating stoves should not be situated so near the opening of the ventilating shaft that the air from them will be drawn into the shaft as fast as delivered. The best position is at the

same end of the room as the shaft, but at one side. Then, the lower inlet only of the shaft being open, the upward tendency of the warm, fresh air from the heater will carry it up out of reach before it can be drawn laterally far enough to enter the shaft. It will then move along the ceiling to the further end of the room, descend to the floor by cooling, and be drawn back into the ventilator only after a circulation through the room more extended and thorough than could be attained with any other relative position of outlet and inlet.

A serious difficulty is often experienced, both with basement furnaces and ventilating stoves, through the action of the wind on the exterior opening of the cold air box or other fresh air supply. It is customary to direct these toward the north or northwest, and the result is that with a high wind from that quarter the air is driven through the air chamber of the furnace and up through the registers much faster than it can be warmed.

The usual remedy is to close the damper in the air box, so that the sectional area of the inward current shall be diminished in proportion to its increased velocity. If the air box were tight and the wind steady this would be correct, but in practice the wind comes in puffs, to guard against which the damper is too much closed, and the normal supply of air being thus curtailed the furnace, to make up the deficiency, draws from the cellar, through the cracks and pores of the air chamber and box, such air as it can find.

If, on the contrary, the sheltered side of the building is chosen for taking in fresh air supply, a strong wind from the opposite quarter will create a vacuum on the lee side of the house strong enough to reverse the natural current, and draw air out of the building through the reg-

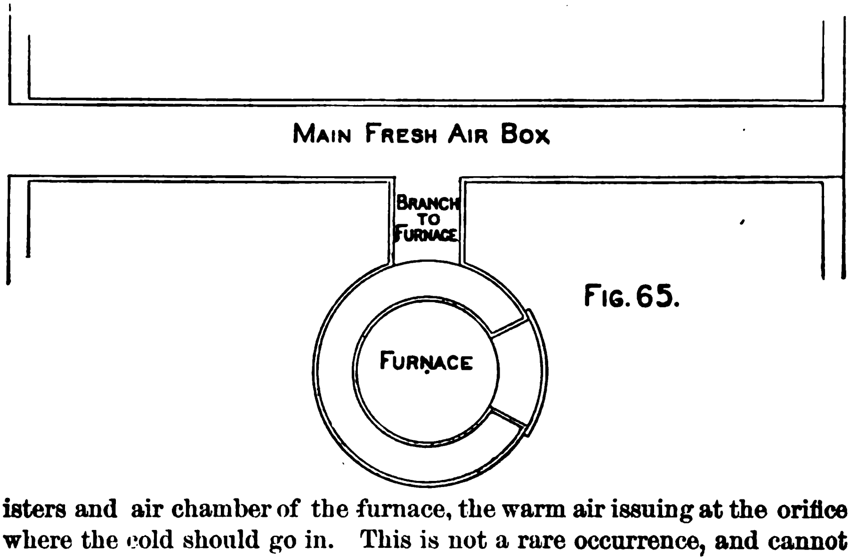


FIG. 65.

isters and air chamber of the furnace, the warm air issuing at the orifice where the cold should go in. This is not a rare occurrence, and cannot be remedied without some trouble.

To obviate both these difficulties and insure a steady and sufficient supply to the stove or furnace at all times, it is only necessary to carry the cold air box through the building, with orifices at each end; the furnace is then supplied by means of a short pipe, drawing from the side of the main box at right angles with it. (Fig. 65.) The wind may then blow through the main box at will without disturbing the furnace, which takes from the stream just what it needs and no more. Where several registers are to be supplied with cold fresh air for mixing with warm, a similar large main box, tapped at right angles by the minor pipes, forms much the best arrangement.

If the force of the wind still makes itself felt in the rooms, a further check may be found in a screen made of two thicknesses of wire gauze, with wool loosely picked and spread between them. Independent of its use for checking the force of the current, this "air filter" is valuable for straining out dust and soot where the fresh air supply is unavoidably taken from a street or other dusty place.

There is much controversy as to the relative merits of cast and wrought iron furnaces. As a rule, more science has been expended on the cast iron varieties and they radiate better and are more economical of fuel than the plate iron forms, which are often nothing more than a simple cylinder inverted over the grate; but it is probable that furnace joints soon become pervious to carbonic oxide gas, and plate iron forms the most reliable security against the mixing of the air with minute quantities of atmospheric poison.

The qualities to be sought for in wrought iron as well as in cast furnaces are tight joints, strength of metal, and the greatest possible extent of radiating surface. The greater the surface the more thoroughly the air will be warmed, such a furnace discharging large volumes of air all at a moderate temperature, while one with small radiating surface sends out a mixture of much cold with a small quantity of highly heated air.

Among the appliances for regulating furnaces, the automatic heat governors should be mentioned. These, by means of the expansion or contraction of rods passing through the air chamber, act upon the check draught damper and the lower door of the furnace, increasing the fire when the temperature in the air chamber falls and checking it when it rises, either by a change in the weather or by the closing of registers above. For so simple and inexpensive an apparatus ($15) it is singularly useful.

In many cases open fireplaces will be used in preference to any kind of stove. There is a very mistaken idea that any room with an open fireplace is sufficiently ventilated, summer and winter, without further apparatus. In winter, it is true, the chimney may be used as an exhaust shaft, so far as its capacity extends, and its action will be increased by the heat of the fire at its foot, but its usefulness depends much on the provision of suitable inlets of fresh air. In warmer weather the im-

pure air collects at the top of the room, and the difference in temperature between the atmosphere within and that without is too small to set up a current capable of drawing down the stagnant upper strata to the floor.

Even if the capacity of the flue should be sufficient for winter ventilation, a separate shaft with an opening at the top is required for spring and fall. The once common practice of putting a register in the smoke flue, near the top of the room, sometimes with but oftener without light valves held open by a spring, but blowing to with any down draught, is too dangerous to be countenanced. The valves, if used, may rust and stick, and such openings have been known to give vent suddenly to sheets of flame.

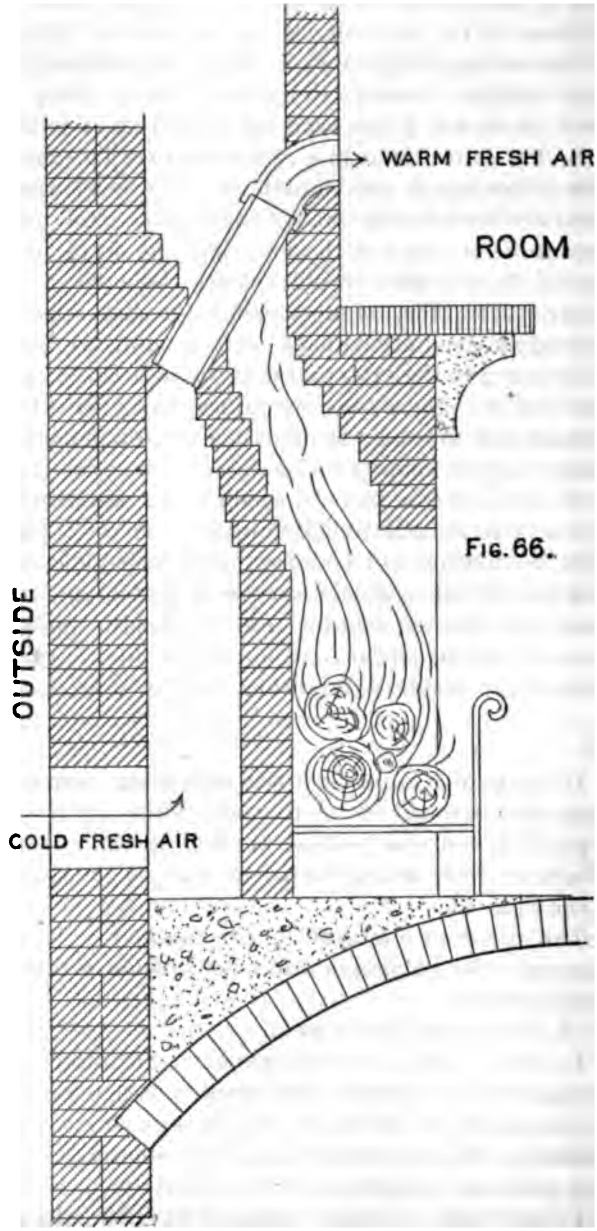


FIG. 66.

The fresh air inlets, wherever open fires are used, must be ample and so placed that their current will not annoy the occupants of the room. Usually, no special inlet is provided, and the fire takes its air where it can find it, sucking it in in small streams through the crevices of doors and windows, walls and floors. These small draughts of cold air, drawn directly from out of doors and crossing the room straight to the fire,

are both uncomfortable and dangerous. A sufficient supply should be specially provided; then these secondary currents will cease. The best way to obtain this supply is by means of a flue passing through or near the fireplace, with an opening at the bottom to the exterior air and another into the room, if possible above the mantel, so that the fresh air, thus warmed, may not be drawn directly into the fireplace but may rise to the ceiling and circulate through the room until sufficiently cooled to descend to the floor, be drawn back to the fire, and consumed or driven off up the chimney. There are endless ways of effecting this; any intelligent mason can accomplish it. One way is to build a false back to the fire place, carrying flues from it to the front of the breast (Fig. 66) above the mantel. These cross flues may be made of brick, or bits of drain pipe can be built in. The heat around them and against the false back warms the air effectually. Still better would be a similar apparatus of iron, but the materials may not be at hand, and a large Fire on the Hearth stove would answer the same purpose better at less expense. Even the roughest chimney may have a similar flue built up at the side instead of the back, with opening in the side of the breast and an opening to the external air at the bottom. (Fig. 67.) The air will be less easily warmed than where the partition is of brick or iron, but to compensate for this the fires in such rough chimneys are likely to be made without sparing fuel.

The homely buildings in which pebble stone or log chimneys are used will be particularly benefited by such an air supply flue; not that they lack ventilation, but because their seams and cracks, from the moment that the fire discovers an easier source of supply, will cease to admit cold draughts. If the flue for fresh warmed air is large enough (it should be considerably larger than the smoke flue), the pressure at the crevices around the walls will be rather outward than inward.

SANITATION.

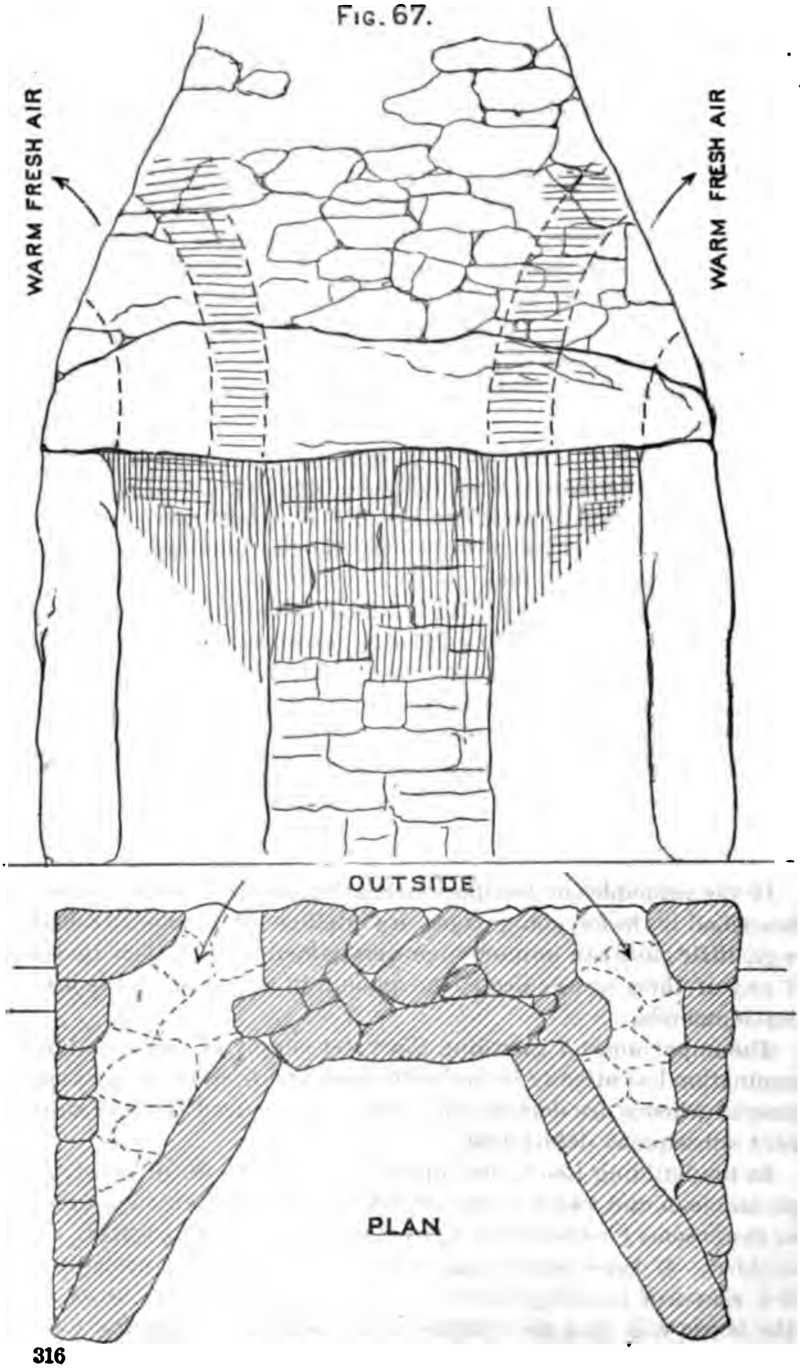
If the principles of ventilation, heating, location, and construction, as described in the foregoing pages, are intelligently applied to school buildings, little more can be done to preserve the health of their inmates, and if any of them are neglected no amount of attention to the others will make amends.

The importance of guarding the water supply of the school from contamination has already been dwelt upon, and frequent inspection of the ground whence are derived the springs which feed the well should prevent subsequent deflement.

In the building itself, the imperative necessity for preserving the cellar air clean and sweet must never be forgotten; basement laboratories or storerooms for chemicals, kerosene, or even coal and wood, should be avoided. If these precautions are observed, the only probable remaining source of impurity will be the sinks or bowls and closets. Of these the bowls will give no trouble if drained into a separate "dry well,"

consisting of a pit some 2 or 3 barrels in capacity, filled with loose stones and sodded over, or still better a line of 50 to 100 feet of sole tile, laid end to end, about a foot below the surface of the ground, and

FIG. 67.



the joints covered with a bit of paper or handful of hay before filling up the trench. The water discharged from the school washbowls is comparatively so clean that there is hardly a possibility of the outlet choking with sediment. It is otherwise with the water closet drainage, which will in time fill up the pores of any soil. The usual course, to postpone as long as possible the evil day when the cesspool must be cleaned out, by making it of great size, is unwise. Aside from the increased cost, the large accumulation of material is at all times much more offensive and dangerous than a small one, and the cleaning out, when it comes, is horrible, while the pumping out of a small reservoir once a week or so is not a serious matter. The best cesspool is a tight tank of brickwork in cement, with brick or concrete bottom and a stone top set in cement. The stone cover may, with advantage, have a common iron pump fixed in it, by means of which the contents of the tank may be pumped out whenever required with the least trouble.

In addition, the cesspool cover should be drilled with a number of holes for admission of air. If the tank is far from the building, it is best to put a trap in the drain pipe, near the house wall. In this case, there will be a constant small effluvium from the cesspool, but, unless it is too large, not enough to reach the building. If space is restricted, the drain pipe should be without a trap and the soil pipes carried well up above the roof. Then the natural warmth of soil pipes and cesspool will cause an upward flow in the now unobstructed line of pipe, the air being drawn in through the holes in the stone cover instead of issuing therefrom, and will be discharged harmlessly into the upper air.

An overflow is usually necessary to any tight cesspool which is in danger of being neglected. This may be carried to a small dry well or other outlet, where its offensiveness will do as little harm as possible.

In many places these dry wells or leaching cesspools will for economy's sake be employed to do the whole work, regardless of the gradual poisoning of the subsoil inseparable from their use. Even in this case, it is well to remember that a small brick tank for first receiving the drainage and allowing it to settle and dissolve is of much value in preventing the clogging of the soil around the leaching pit.

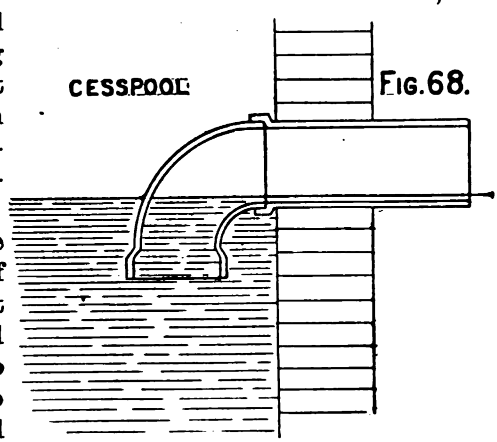


FIG. 68.

The overflow pipe should be built into the wall about half its diameter below the inlet pipe, and a quarter bend should be previously cemented in, so that when set this will dip below the surface of the liquid in the cesspool. (Fig. 68.) By this means, the scum and paper which

always float on the top will be prevented from entering and choking the overflow pipe.

The drain pipe should be of vitrified earthenware outside the building, jointed with cement and the joints scraped out clean. Inside or under the house nothing should be used but cast iron of the best possible make and jointed with melted lead. Four pounds of lead is not too much for each joint in a four-inch pipe, and it must be well caulked in. This soil pipe must be carried well up above the roof, and the end left open. If this is not done, the flow of water through the traps will at times siphon them out, leaving free communication between the house and the interior of the drain, and any expansion in hot weather of the air contained in the soil pipe will force bubbles through the traps to contaminate the atmosphere of the rooms.

These points being properly arranged, there will be, with good water closets, well set, nothing to fear from the plumbing. With plenty of water, the best closets are the enamelled hoppers with enamelled traps, supplied automatically by a tank with siphon or "tumbler," so as to flush all the closets once in ten minutes through the day. This is also an economical arrangement, as one tank will supply a number of closets, but consumes much water. Next in cleanliness as well as in consumption of water come the Jennings and Demarest closets, then the Hellyer, American Defiance, Climax, and Whirlpool varieties; last, the common pan closets. Hoppers without abundant, and if possible automatic, flushing are liable to become nuisances.

The evils of pan closets are much mitigated by using only those with enamelled receivers, but, common as they are, none remain long free from offense. All the varieties may be arranged for automatic action, the valves being operated by the opening and shutting of the door or pressure on the seat, and this is strongly to be recommended.

Many large schools use the latrines made by J. L. Mott & Co., New York, and others, which consist of a long trough filled with water, which is emptied and flushed two or three times daily by a janitor or servant. These are useful, but hardly suitable for small schools.

In general, whatever plumbing is used should be of the best and most thorough kind. A country-built house with country plumbing is apt to be a dangerous place to inhabit, and school houses and public buildings are even worse.

Urinals become exceedingly offensive unless well looked after. Wherever possible, they should have floor and partitions of slate or marble, for easy washing, and should in any case be in a well aired place. A piece of common bar soap is often placed in urinals to lessen the odor from them and is of considerable use.

Earth closets, which will in the majority of cases form the most available appliance, differ only from a well arranged privy in the fittings by which at intervals a small quantity of sifted dry earth is thrown on the matter in the vault. A very small quantity, if evenly spread, acts as

a complete disinfectant, and earth closets are nearly as free from offense as the best water closets—much more so than inferior ones—with the advantages of simplicity, cheapness, and availability in cold weather.

The simpler the apparatus the better; those for house use often come provided with springs for automatic sprinkling of the earth, slides to

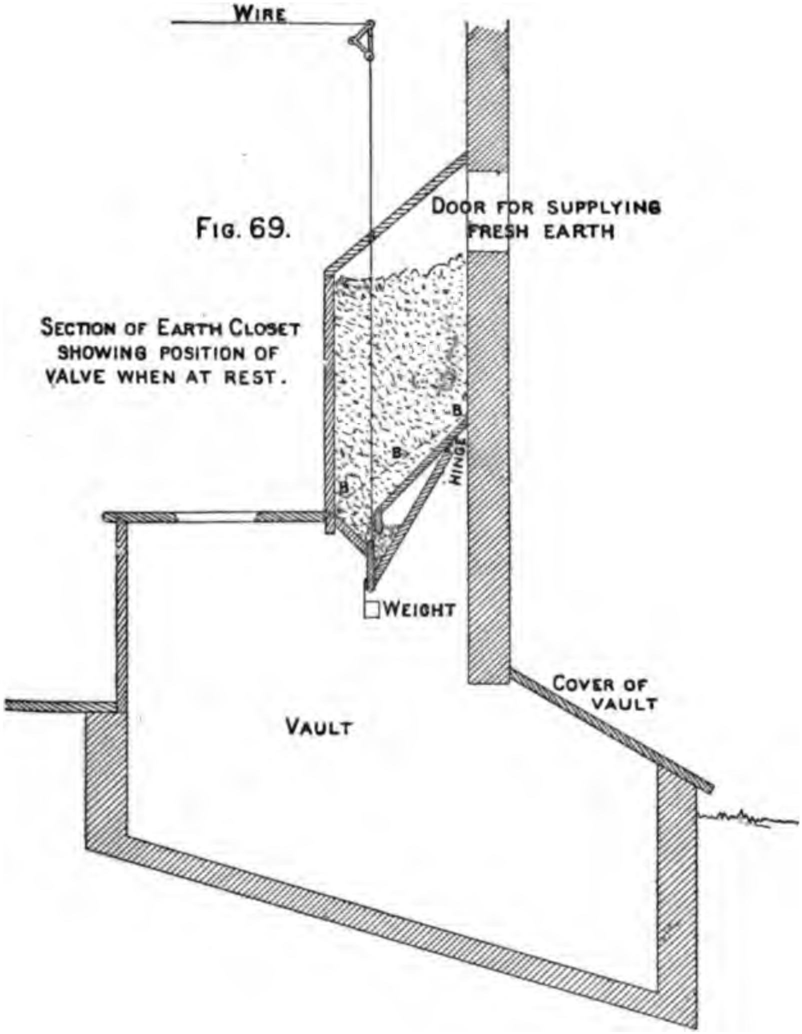


FIG. 69.

SECTION OF EARTH CLOSET SHOWING POSITION OF VALVE WHEN AT REST.

enclose the receptacle when not in use, &c., all of which are best dispensed with in schools. Not knowing of any ready made appliance exactly suited to the mode of treatment which he proposes, the writer suggests the following, which works well in the model at least.

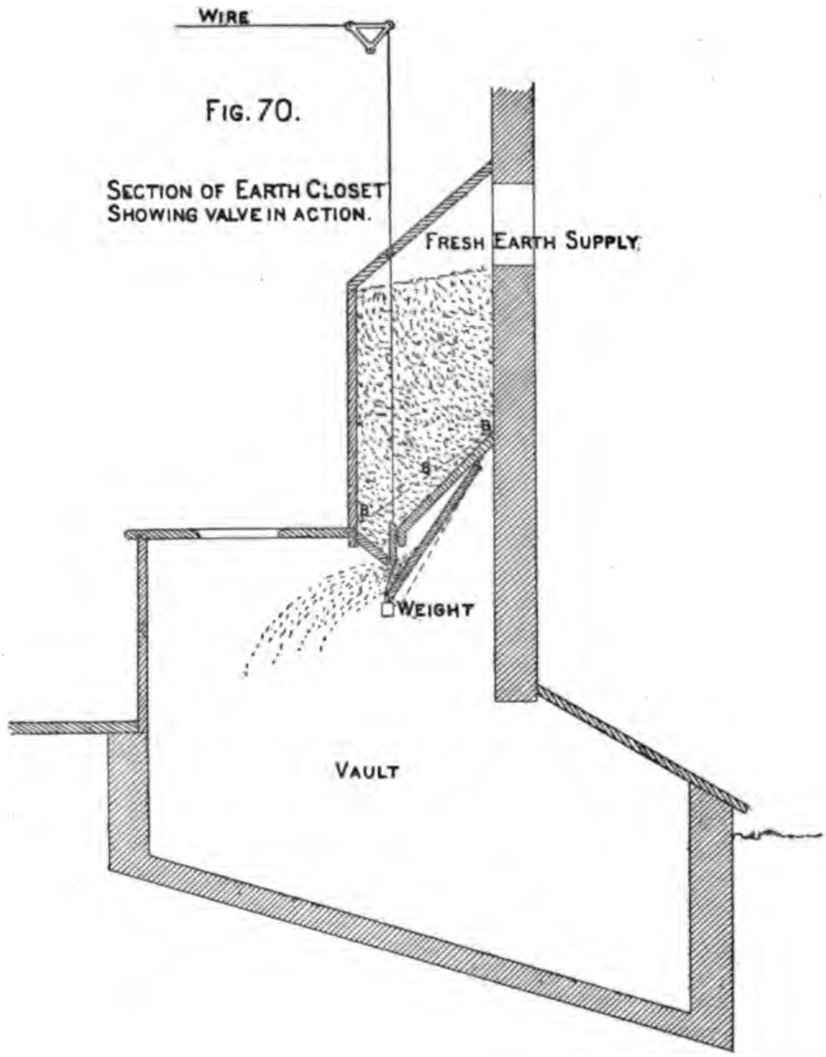
What is needed is a capacious reservoir for the dried earth, a measurer to receive from the reservoir a certain small quantity, and a means of

throwing out the earth contained in the measurer at will in a uniform sheet over the vault, after which operation another given dose should fall into the measurer, to be ready for the next operation.

In Figs. 69 and 70 the reservoir or hopper is filled with a shovel from the outside through the opening. A lid of plain boards is hinged to the

FIG. 70.

SECTION OF EARTH CLOSET SHOWING VALVE IN ACTION.



back of the hopper. Fig. 69 shows it at rest, the weight of the earth holding the lid back and the opening being closed by a slide. By pushing in a lever, pulling a cord, or other means, the inverted lid is thrown

forward, as shown in Fig. 70, and the slide raised, shutting off the descent of earth from the hopper above into the measurer, but throwing the portion already contained in it over the vault in a uniform sheet. On the relaxing of the impulse the weight draws the slide back and supplies the measurer with a fresh dose. By regulating the front edge of the measurer the sheet of earth may be directed as required. B B B is a sheet of wire netting fixed in the hopper, which serves to sift the earth and to prevent it from packing so firmly in the bottom as to impede the movement of the measurer. The jar communicated to the apparatus shakes down the earth, a matter of some importance. Very possibly there may be better modes of accomplishing the same result; the writer merely suggests this as illustrating the end to be attained and the simplicity of means desirable.

A separate box may be fitted to every seat, or one may serve for two or three. Perhaps the best means for discharging the earth will be by cords under the supervision of the teacher.

The vault may, with advantage, consist of tight plank boxes on wheels, so as to be easily rolled out for emptying. If this is impracticable, a shallow pit lined with 8-inch brickwork in cement, and with bottom of bricks on edge, also laid in cement, is necessary, and for facility of cleaning the bottom may slope outward. The vault should be accessible from the outside, but closed by strong and tight doors with lock and key.

The earth used in these closets should be loam or clay, not sand. It should be dried in the sun or by a fire, sifted, and stored in a dry place. The screen for sifting should have about three meshes to the inch; and coal ashes, similarly sifted, may be added to the mixture in quantity equal to the earth without harm. Wood ashes or lime should not be used.

The earth taken out of the vaults may be dried and used over again indefinitely. It retains no trace of the organic matter which it has helped to decompose. The quantity required may be easily calculated. About 1½ pints, or 2½ pounds, of average earth per closet will generally be enough for each discharge, supposing these to take place four or five times daily; and the capacity of the reservoir divided by this will give the length of the interval between successive fillings. If several relays of earth are dried and stored in barrels, there need be no interruption to the working of the apparatus.

A privy is simply an earth closet without the disinfecting earth, and needs no further description. The vault should be small, built of brick in cement, with brick bottom sloping toward the rear, and tight door for cleaning out, as described above. In addition, the vault should be provided with a ventilating pipe, carried up well above the roof. This is best of galvanized iron, but may be of wood if perfectly tight. The doors opening into the vault should be made tight with list or weather moulding, and all crevices cemented up. If this is thoroughly done, there will be a pretty constant current of air downward through the seats,

thence up through the shaft into the atmosphere, and no odor will be perceived even directly over the seat. The top of the ventilating shaft should be protected by a cap if higher roofs about it are likely to cause down draughts. Unless the vault is tight, no ventilation will prevent stench from the saturated soil around it.

ACOUSTICS.

The dimensions of school-rooms are generally fixed by other considerations, but some attention may be paid to acoustic quality without detriment to the other uses of the building.

The most common mistake is in making the room too high. Anything over 13 feet is likely in a room not over 40 feet square to cause that confusion of sounds and echoes which constitutes what is called a "noisy" room. Twelve feet is still better as to this point. Painted or impervious walls also promote echo and noisiness, and the dampness of fresh plaster, closing its pores like paint, often causes the same unpleasant effect, which however disappears as the wall dries out.

Little can be done to cure such a room, if originally wrongly proportioned, except putting in a new ceiling hung below the old.

Occasionally echoes from the blank end walls may annoy teachers or scholars. Something may be done to remedy this by hanging maps or any soft elastic substance against the offending wall. If desks are placed next the side walls, which should never be the case, there is very likely to be an indistinctness of sound there, from the intermingling of sound waves transmitted at different velocities through the air and along the solid substance and reflected from the rear. This can be partly remedied by cutting off the rear angles of the room by a board set in the corner, as at X; but the desks should be moved away from the walls. (Fig. 71.)

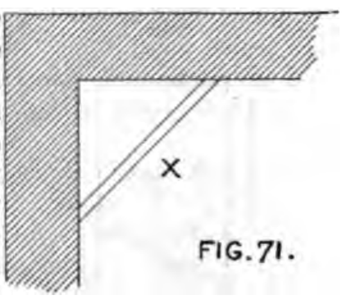


FIG. 71.

ATTRACTIVENESS AND ECONOMY IN BUILDING.

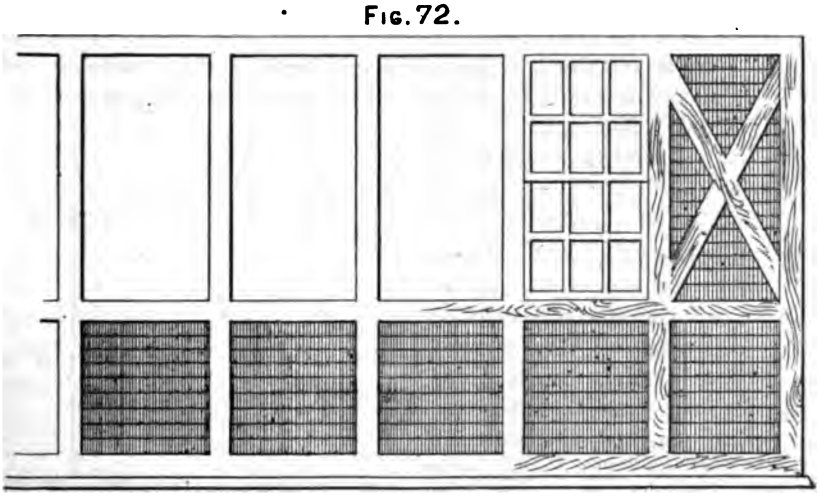
These two qualities are perhaps not altogether compatible, at least not in their highest development; but it is rare to find any building which does not show some sacrifice to appearance, and with care and knowledge little expenditure is needed to secure some measure of picturesque beauty. For this, however, the first requisite is good construction. Elaboration of detail only adds to the repulsiveness of a structure tainted with premature decay. To begin with frame structures, all woodwork should be kept from contact with earth, and even when brought into juxtaposition with masonry should be well painted to repel the inevitable dampness. The end grain of timber needs most to be protected, and the tenons of beams framed into girders. The end joints

of clapboards, especially where they abut against a casings or corner boards and all similar points, may with great advantage be coated with paint before the parts are brought together. This will prevent the springing out of clapboards or siding at ends through the breaking away by incipient rotting of the wood around the nails in those places, which soon disfigures buildings not well cared for. In the same way, plank walks and outside woodwork will keep in good condition much longer if the ends of the planks are painted.

Another important though commonly neglected point is the use of galvanized nails for putting on clapboards and outside finish. The usual way is to employ ordinary nails and "set in" the heads far enough to allow a little putty to be daubed over them before painting the second coat. This keeps the water out till the builder gets his pay. Soon afterwards the continual shrinking and swelling of the boards by the vicissitudes of weather open a little crack around the putty, through which moisture penetrates, to exude again, leaving a rusty streak below every nail hole. In dwelling-houses painted every five years or so, this is less important, but neglect must be assumed to be the normal condition of school-houses, and its evil effects must be provided against so far as practicable in the first place.

All other points of strength and quality of material should be well looked after. Gutter irons should not be over 30 inches apart; shingles should not show more than one-third their length to the weather; clapboards 6 inches wide should lap at least 1½ inches; the tops of door and

FIG. 72.



window casings should be rebated or flashed with sheet lead to prevent the entry of water over them; door and window stools should pitch sharply to throw water quickly off; and, as a rule, eaves should have considerable projection, a matter of importance in promoting the dryness of the building.

It is very common to dispense with gutters in small rural buildings; but the constant dripping of eaves without them wears away the grass in an irregular and untidy line around the edifice.

If the construction is judicious and the materials are good and used with due regard to their properties, not trying to bend straight clapboards around circular projections or to glue up narrow boards into fictitious panels of immoderate size, little is necessary to satisfy the eye at least. By painting in a variety of tints, a wide field is opened for giving interest to the plainest structure.

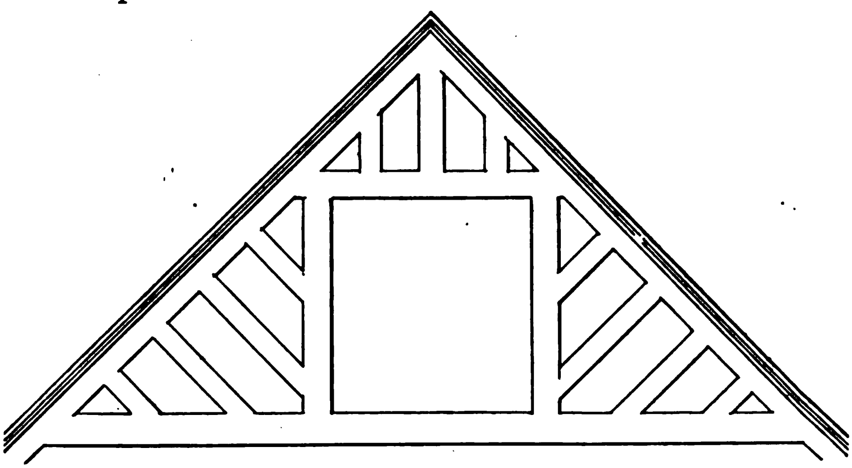


FIG. 73.

To begin with the most humble efforts at color decoration, a pleasant harmony may be obtained by leaving the shingles and siding boards of a frame structure unpainted, covering only the corner boards and "finish" with light red. The mineral reds answer well, if brightened with yellow ochre, and are cheap. Doors should have red panels and unpainted stiles, or vice versa. Where the windows are numerous and the finish work forms a comparatively large proportion of the surface, great picturesqueness may be given by painting the siding, leaving casings, corner boards, belts, and roof plain. (Fig. 72.) The harmony of gray and pink or rose color, which a few months of weathering gives the work, is peculiarly pleasant when treated in the latter mode.

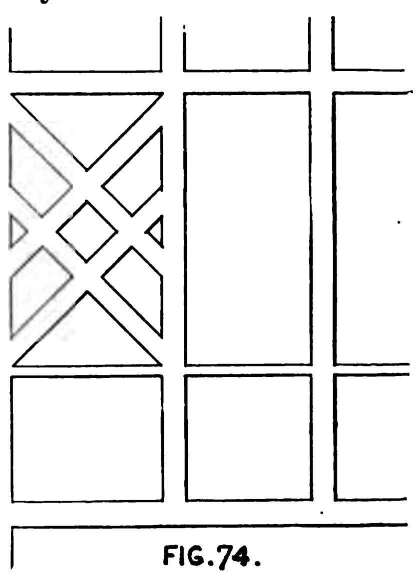


FIG. 74.

In order to manage the color effect nicely with any combination

of tints, it is often desirable to break up a surface which would otherwise give too large a mass of one shade by belts or bands in various patterns. These may be readily and cheaply made by putting boards directly

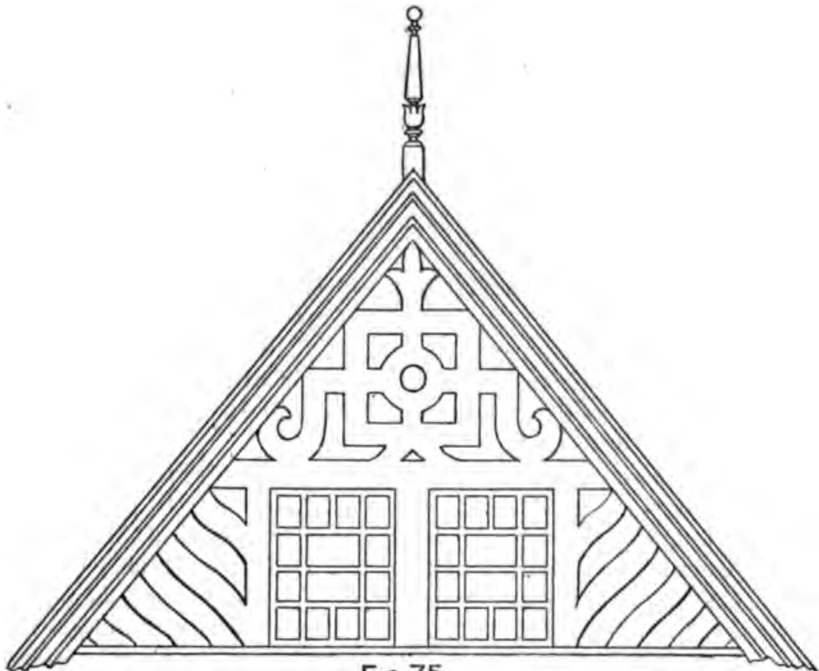


FIG. 75.

over the shingles or clapboarding. In this way there will be no need of "grafting" or flashings, which are necessary where the bands are nailed on the under boarding and shingled or clapboarded up to in the common way, and the effect is if anything rather in favor of the cheaper mode, which gives more projection than the other. Figs. 73, 74, and 75 give a variety of suggestions.

A little ingenuity will secure much beauty with two colors, the principal point being to avoid heavy masses of unbroken tint. Every opportunity should be seized for changing from one color to the other, especially about porches and balustrades, which demand delicate treatment.

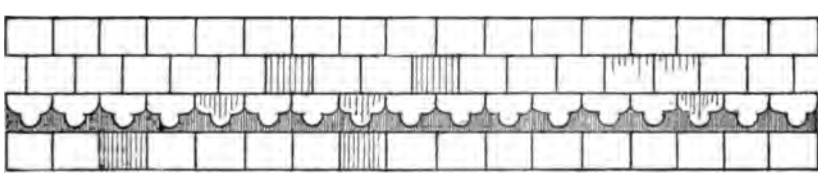


FIG. 76.

It will often be found, however, that the porch detail is too small for the rest of the building, which looks heavy and clumsy by contrast. In

this case, a corresponding delicacy may be suggested in the main portion by a narrow belt or two, or a row of shingles with cut ends may be carried around it, and the intervals, being painted of a different color, will present a chain of colored points, restoring smallness of scale and "preciousness" to the whole. (Fig. 76.)

Where the whole of the outside woodwork is painted, the best effect will be found in employing three or four different colors. One of these should always in the country be an olive or brownish green, to recall and as it were tie the building down to the general surface of grass and earth about it. The other tints may be varieties of the same green, made by modifying it with blue, yellow, or brown. This, with the roof painted a brownish red, using any of the red mineral pigments now in the market, will give a pleasant effect, especially if touches of red are introduced at different points in the mass of green, as on window sashes, brackets, ends of rafters, panel mouldings of doors, turned work, &c. If a more lively impression upon the eye is desired the indispensable olive green may be boldly associated with the red and violet, which will complete the full color scale.

It is said by some oculists that the retina of the eye is composed of three layers of nerve substance, one of which responds to green rays, another to red, and the third to violet. White light, in which all the rays are contained, calls the whole of the retina into action; colored light, on the contrary, excites only its special layer, leaving the others quiescent. Hence it follows that in observing party-colored objects the optic nerve is more or less unequally brought into action, and in consequence unpleasantly affected, according as the proportions of the various hues depart from or approach that proportion which would stimulate the three sensitive layers equally. When this proportion is reached, whether by pure colors or subtle mixtures, the eye experiences a sensation of rest and satisfaction. This is what is meant by the term "color harmony." Just what are the relative proportions and the shades of color which constitute perfect harmony we cannot yet say. In general, if the three quasi primary colors, red, green, and violet, are presented of equal intensity and in equal areas, the eye will be roughly satisfied.

For our purpose, the violet may be represented by the dark "slate paints" sold for putting on roofs, modified by admixture of other pigments if desired. The green should be of an olive cast and the red may be any warm ochrey color not too dark. The red is likely to be the most intense of the three; if so, it must present proportionately less surface, and in the same way the area of the other colors must be in inverse proportion to their intensity to keep the balance right. Some ingenuity will be required in managing the colored surfaces. The roof, if it shows about one-third of the total visual area, may be painted with the slate color at once. If it shows more, the violet should be lightened or modified; if less, intensified. To divide the red and green equally, excuses must be sought for painting gables, for coloring the wall beneath

FIG. 77.

a belt differently from that above, showing doors with red panels in green framework, and so on. In case of necessity, the red can be so intensified with vermilion that its area may be made relatively small. Endless combinations will suggest themselves to any one who once understands the simple principles from which he should work.

More complex harmonies may be tried in reserving, say, a portion of the green, separating it into blue and yellow, and with these decorating prominent points; or, by keeping the green of a bluish cast, enough free yellow, so to speak, will be liberated to enliven gables or similar points. It is safest, however, to experiment with the tints rather subdued.

Inside the building, decoration must necessarily be restrained. The ennobling frescoes of battle scenes and deeds of heroism which some wish to see on school room walls are hardly for our day; the best we can hope for will be coarse maps or diagrams. Ceilings should be white, for the sake of their reflected light. Floors and woodwork offer some opportunity for picturesque effect. The former, in the districts where black walnut is abundant, may at trifling expense be laid with alternate strips of this and a lighter wood, pine or spruce. Refuse walnut may be used, white sap not being a serious defect for this purpose. The floor should be laid without a border, which cannot, unless special preparation is made for it, be nailed firmly enough for school-house wear.

In a similar manner, doors and wainscot may have panels of one wood and framing of another. White wood (tulip or basswood) panels, in pine or spruce framing, look well; if oiled, they quickly turn to a brown shade. Cap mouldings of wainscots may be dark wood and panels or other members may be painted, leaving the remaining parts natural or of a different color. Bronze green framing may have Indian red panels, or vice versa, and so on. All these things help to "dress up" a room, and though too violent for private dwellings they are not so for a school-house and do much to keep it looking bright and fresh without increasing its cost.

Brick buildings need less exterior decoration; massiveness is their proper quality, and whatever increases the impression of this helps the effect of the building. Reveals, that is, the sides of the window and door recesses, should be deep. For instance, in a 16-inch hollow wall it is possible either to put the window frame near the inside of the wall, leaving 12 inches of brick surface to form the outer part of the recess, or to set the frame only 4 inches back from the general wall surface, in which case there will be a considerable interior reveal, to be plastered or lined with wood. Of these two modes, the former has much the better appearance.

With brick or stone walls a peculiarly picturesque and pleasant effect is given by using tiles for roof covering instead of slates or shingles. Those made at Akron, Ohio, by Merrill, Ewart & Co., have projecting lips, which much improve the tightness of the roof laid with them.

Without some such device ordinary tile roofs will admit dry, drifting snow, unless made of very steep pitch, but it is safe to use them where only rain is to be feared.

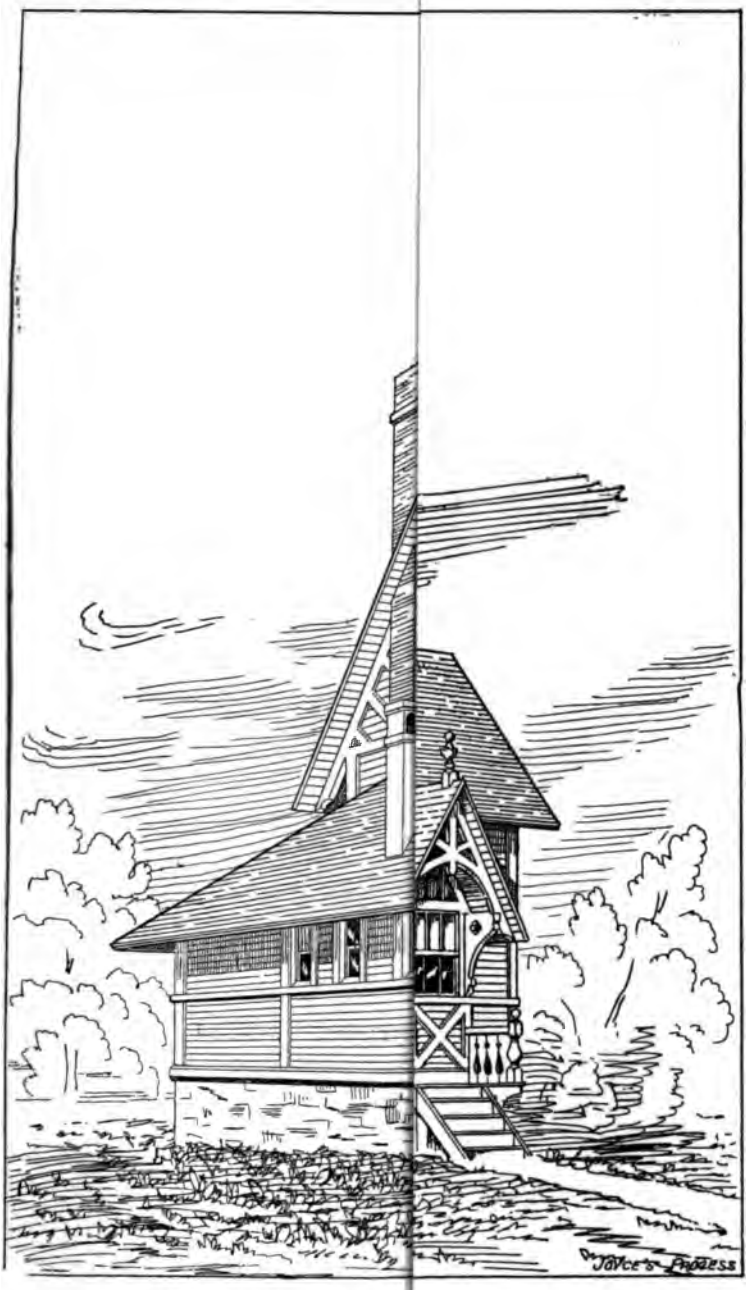
It is very fashionable in England to paint the woodwork of brick buildings—sashes and frames of windows, doors, and balustrades—white, and the effect is pleasant. The sash bars are made quite thick—seven-eighths of an inch, instead of the five-eighths usual with us—to avoid the spider web look of the lines, and small lights are used. In some cases the frames and sashes are even gilded, so there is no want of example for the exercise of fancy in decoration of this kind. Figs. 77, 78, and 79 show different modes of treating the model plan. Fig. 80 shows a small English school-house recently built.

SPECIFICATIONS AND CONTRACTS.

It only remains to suggest models for specifications and contracts which shall be suitable for ordinary cases. To present a separate model for each kind of building, brick, stone, and wood, is unnecessary; any one can make the requisite changes to suit a given specification to one or the other construction. What seems most essential is that the model shall include *all* that is needed for a particular building. Then, for a structure of the same kind, the specification can be adopted entire, with assurance that there is nothing omitted, and for one of a different sort the completeness of the model will help to call attention to all the points which need modification.

In the same way, in regard to contracts, there is much less danger that an intelligent committee or superintendent will be unable to modify a given form to adapt it to various circumstances than that, if the model before them is too general or incomplete, as such models usually are, they will not be able from their own experience to supply those numerous clauses and conditions for want of which serious trouble may afterward arise.

It seems best, therefore, to give a full specification for an ordinary frame structure of the best and most thorough kind; such a one as an architect desirous of saving his employers from bills of extras would think it necessary to use. Following this is a form of contract which, though much longer than the agreements that are frequently used, is as condensed as it can be without leaving out clauses which, though in nine cases out of ten needless, the tenth time become of great importance. It is the essence of a good contract that it shall leave no contingency unprovided for. Long experience has shown that all the emergencies contemplated in this model are liable to occur, and it is for the benefit both of builder and owner to have their rights and duties in such cases defined beforehand, so that no apology is needed for the length of the document. It will rarely be necessary to call in a lawyer to draw up such papers, unless some very unusual stipulation is to be introduced.


Joyce's Process

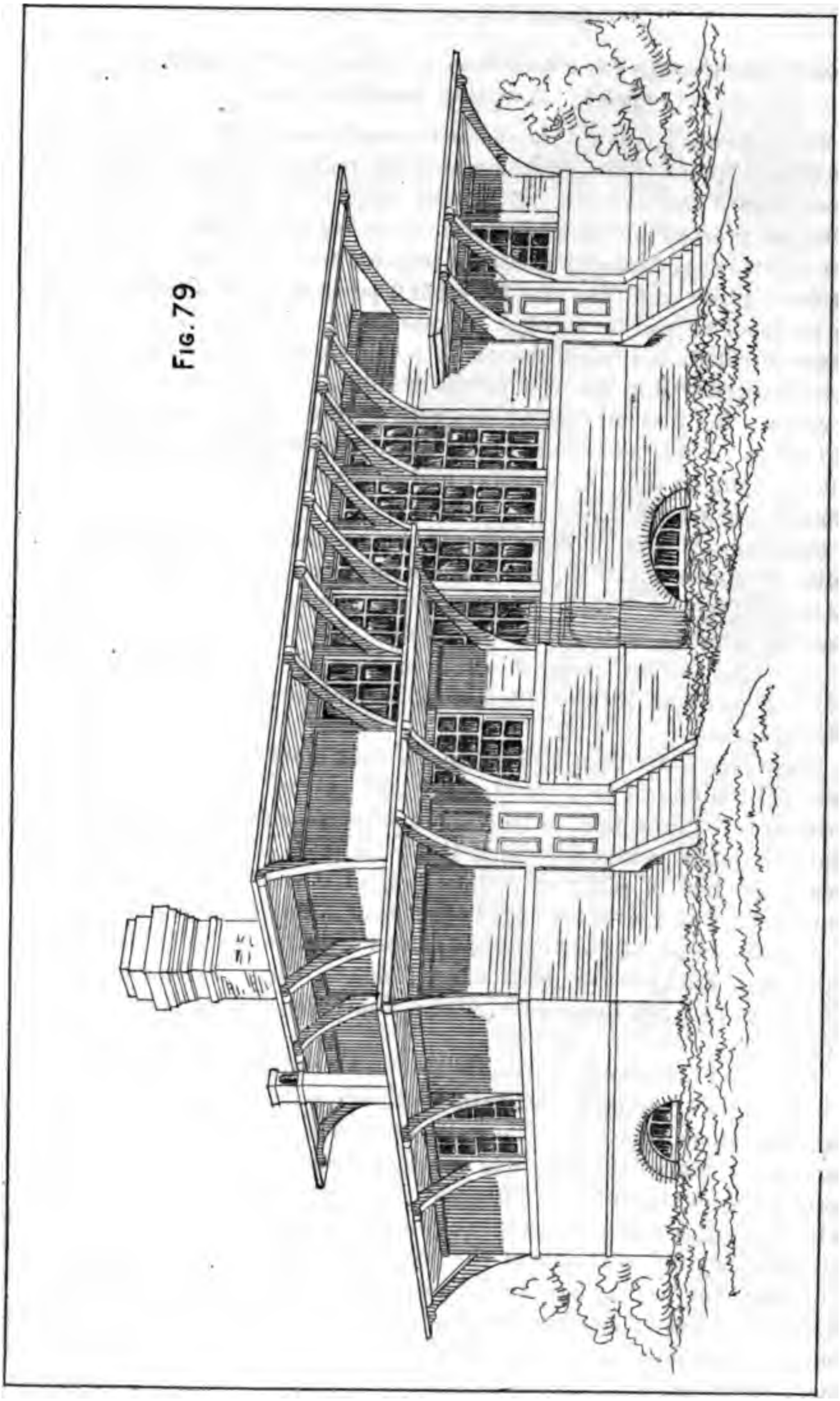


Fig. 79

MODEL FOR SPECIFICATIONS.

Mason's specification for school-house to be built for the inhabitants of the town of X on their land on Y street.

Excavation.—Excavate the cellar to a uniform depth of 3½ feet below the highest point of the ground which the building covers, making the excavation 8 inches wider all around than the outside of foundation walls, as marked on plan; excavate trenches for all walls and piers 2 feet below cellar bottom; excavate trench 4 feet deep and 100 feet long for drain pipe; and excavate for setting posts of porch 4 feet deep, and for cesspool as shown on plan. Separate the loam and stack by itself where directed, and dump the other earth from the excavations wherever directed within 200 feet of the building. Excavate for bulkhead to cellar. Refill about cellar walls with gravel. Refill around cesspool and posts. Level and grade neatly about the building as directed, and put the loam on top. Clear away and remove all rubbish and leave the ground in good order.

Blasting.—If any blasting should be necessary for excavating the cellar as above specified, seven cents (more or less) per cubic foot will be allowed by the town for blasting and removing the stone, and all the stone so removed which may be suitable shall be used in building the cellar walls, and for all stone so taken from the cellar and used in the walls the town shall be credited at the rate of seven cents (more or less) per cubic foot.

Drain-pipe.—Furnish and lay in the best manner from cellar wall to cesspool 100 feet of first quality (*Portland, Akron Scotch*) 6-inch glazed earthenware drain pipe, to be jointed with clear fresh Portland cement and the joints scraped smooth inside as laid; all uniformly graded. Leave the line of pipes open until inspected and approved, then refill the trench with earth, the last 12 inches of filling to be loam.

Foundations.—All the lime used in the mason work to be No. 1 extra Rockland, Rockport, or Thomaston (*Canaan, Glen's Falls*, &c.), and all cement to be fresh Rosendale (*Akron, Louisville, Portland*) of the ——— brand.

Walls.—Furnish all materials and build cellar wall as follows: Put first into the trenches 18 inches in depth of quarry chips or broken stone, dry, and upon this build the walls 18 inches thick in ledge stone laid in mortar made with lime and cement in equal parts and clean sharp sand in proper proportion; the wall to be well bonded, the joints filled with mortar, and the whole trowel pointed outside and inside the whole height. Set the best face of the stones outside, both above and below ground. Set footing stones for piers and chimneys. Build bulkhead walls of stone in cement mortar, neatly faced. Bed the sill of the building in cement mortar, and bed and point up around frames of basement windows.

Cesspool.—Build a tight brick circular cesspool 5 feet inside diameter

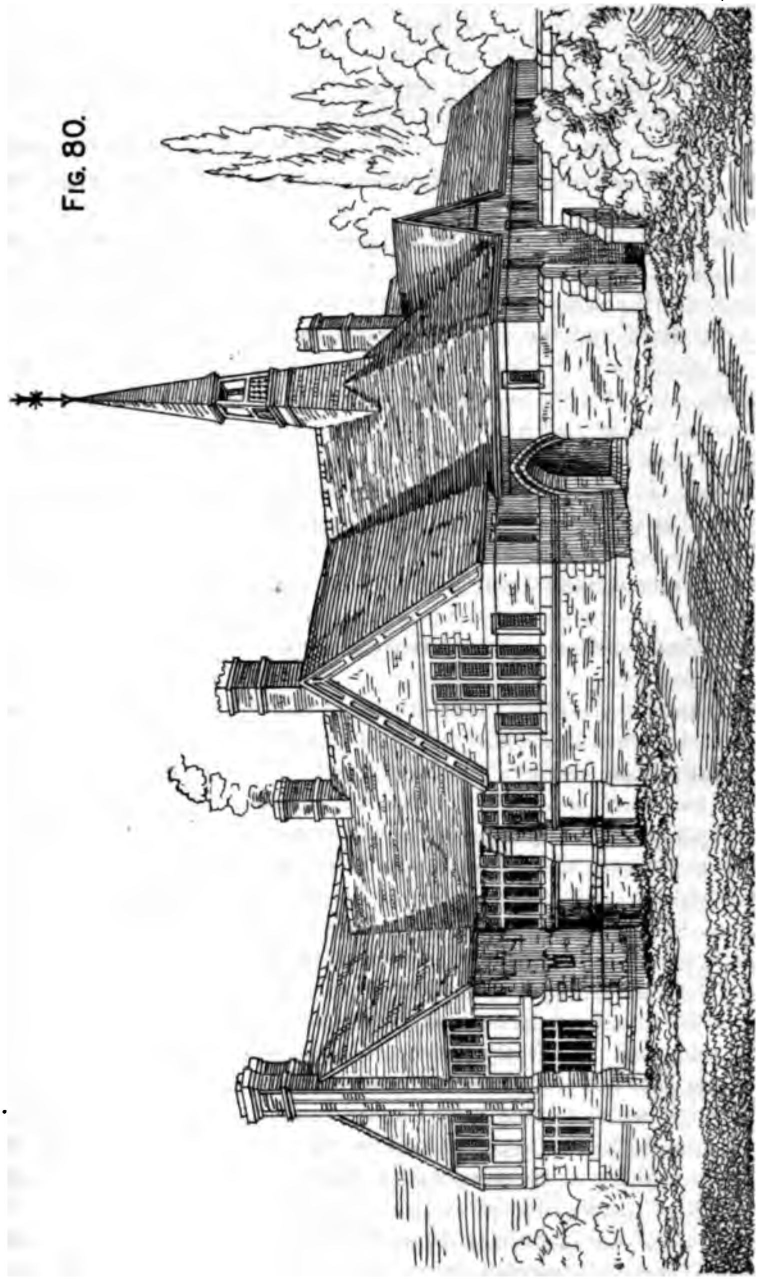


Fig. 80.

and 5 feet deep below spring of arch, the walls to be 8 inches thick. of hard brick in cement. Dome over the top 4 inches thick. and lay the bottom 4 inches thick, all of hard brick in cement. Leave manhole 20 inches in diameter, and cover with a 3-inch bluestone 2 feet square, with hole cut in the top and iron grating. Build in the overflow and inlet pipes. Carry overflow to small dry well.

Brick-work: Piers.—Build (*four*) piers in cellar, 12 by 12 inches, to under side of girders, of hard brick in mortar made with equal parts of lime and cement.

Chimneys.—Build chimneys, as shown on drawings, of hard brick in lime mortar to under side of roof boarding, above roof to be selected brick in mortar made with one part cement to two parts clean sharp sand (no lime), and the four upper courses to be laid in clear cement; all withs to be 4 inches thick, bonded into the walls, and all flues carried up separately to the top. Plaster every flue inside, brushing the mortar smooth with a wet brush, and the outside of the chimney to under side of roof boarding.

Provide and set iron thimbles and cover for stove pipe (*furnace*) and two 20 by 30 Creamer's ventilating registers, black japanned, with cords, &c., complete.

Lay three courses of rough brick in mortar between the beams on top of sill.

Plastering: Cellar ceiling.—Lath and plaster the cellar ceiling one coat, smoothed.

Back plastering.—Back plaster the outside walls from sill to under side of plate, between the studs; the laths to be nailed to vertical strips or laths put on the inside of the boarding.

Two coat work.—Lath and plaster two coats in the best manner all other walls and ceilings except in woodshed, carrying the plaster to the floor everywhere. Laths to be seasoned pine or spruce, laid ⅜ inch open, and breaking joint every six courses and over all door and window heads. The first coat of plaster to be of extra (*Rockland*) lime and clean, washed, sharp sand, and well mixed with long hair. The lime is to be slaked separately at least seven days before mixing with the sand and hair. The first coat to be well trowelled, straightened with a straight edge, and made perfectly true, and brought well up to the grounds. The skim coat is to be made with extra (*Rockland*) lime, slaked at least seven days before mixing, and washed (*beach*) sand, and well floated.

Point up with lime and hair mortar around window and door frames; patch up and repair all the plastering at the completion of the building, and leave all perfect.

Carpenter's specifications, &c.: Scantlings.—Sill 6 by 6 (*creosoted by Hayford Wood Preserving Company*), well painted on the under side. Plate, 4 by 4; corner posts, 4 by 6; window studs, 3 by 4; door studs, 4 by 4; all other studding, 2 by 4; 16 inches on centres. Braces, 1½ by 4, gained in on the outside of the studding. There will be one 6 by 10

girder through the middle of the building, and the floor beams will be all 2 by 8 (2 by 9), (2 by 10), 16 inches on centres, notched down 4 inches on the sill and 1 inch on the girder. Rafters 2 by 8 (2 by 9), (2 by 10), 20 inches on centres, every pair of rafters to be tied at the foot with 1¼-inch plank at least 8 inches wide. (If space is gained overhead by putting the ties part way up the rafters these must be 2 by 10 or 2 by 12.) Hip and valley rafters 2 by 12 (3 by 12), (3 by 14). All rafters to be notched on the plate and spiked. Bridge the floor with two rows of double herringbone crossbridging.

Cornice.—Form cornice as shown on drawings, with gutter all around the building, and two (*four*) 3-inch patent expanding galvanized iron conductors where directed, with 2-inch lead goosenecks and quarter-turn at foot of each. Joints in gutters to be made tight with sheet lead.

Roofing.—Cover the roof with hemlock (*spruce*) (*pine*) boarding, planed one side to an even thickness, and two thicknesses of pine tarred (*Virginia rosin sized*) (*asphalted, Beaver brand*) felt paper.

Shingles.—Shingle with good sawed pine (*sawed or shaved cedar*) [sawed shingles rot sooner, but hold paint better] shingles laid 4½ inches to the weather and put on with two galvanized (*Swedes iron*) nails to each shingle.

Roofing with slate.—Cover the roof with matched pine boards, planed one side, two thicknesses pine tarred paper, and slate with best eastern (Peachbottom) (Chapman's) (Vermont green) (red) slate not over 8 by 16, laid with 3 inches lap, and nailed with two galvanized (patent) nails to each slate.

Flashings.—Cut channels in brick work of chimney and cement in wide flashings of 4-pound lead; shingle in (*slate in*) wide zinc flashings in valleys, and warrant all tight for one year. (*Cover ridge of slate roof with 4-pound lead, and slate in wide flashings on hips.*)

Outside finish.—Make finish and outside ornamental work, porch, &c., all of clear, seasoned pine, according to detail drawings.

Walls.—Inclose the walls with hemlock boards (*pine or spruce*) planed one side to an even thickness, and two thicknesses of good felt (*cane fibre*) paper, breaking joint, and cover with sap extra pine clapboards, 4½ inches to the weather (*edge sprung boards*) (*matched or rebated boards*) (*shingles*), all nailed with galvanized nails to every stud.

Casings, &c.—Casings and cornerboards 1¼ inches (⅞) thick. The top of all casings to be rebated and the under side of window sills ploughed to receive clapboards or shingles.

Porches.—Porches to stand on cedar (*locust*) (*creosoted spruce*) posts, 4 feet in the ground. Floors framed with 2 by 8 beams, and covered with matched ⅞-inch Georgia pine boards, well nailed and edge rounded. Fill in beneath with ⅞-inch boards jig-sawed as per detail drawing. Roof to have 2 by 4 rafters, with roofing as for main roofs, and ceiled underneath with ⅞-inch matched and beaded sheathing not over 4 inches wide, as shown on drawings.

Outside steps.—Make outside steps with ⅞-inch pine risers and 1¼-inch Georgia pine treads, with rounded nosings returned at the ends, all supported on 2 by 12 inch strings, 12 inches on centres, the outer strings to be planed, and the foot of the strings to abut on a 4 by 4 piece, supported by two cedar (*locust*, &c.) posts, 4 feet in the ground. Make bulkhead to cellar with plank steps on plank strings, and cover of matched boards, battened, hung, and made tight.

Inside flooring.—Woodshed to have single floor of planed 2-inch plank. Other inside flooring to be double; under floor of planed hemlock (*second quality pine or spruce*) boards and upper floor of thoroughly seasoned and kiln dried first quality ⅞ matched Georgia pine, not over 4 inches wide, laid in courses, breaking joint every course, thoroughly strained, and well blind nailed to every beam; all to be well smoothed and scrubbed at the completion of the building. Put felt paper between upper and under floor. (*Single floor of 1¼ matched Georgia pine.*)

Grounds and furring.—Put on grounds for ⅞-inch plastering and beads on all angles. Cross fur the ceiling with 1 by 2 strips, 12 inches on centres.

Partitions.—Partitions to be set with 2 by 4 studs, 16 inches on centres, well straightened before plastering, and bridged once with angular plank bridging. Truss partitions where required.

Inside finish.—The inside finish to be all of first quality Indiana calico ash (*Michigan ash, Eastern brown ash, oak, cherry, black walnut, pine, whitewood*).

Wainscot.—Make panelled wainscot around main and class rooms and vestibules, as shown on drawings, in long horizontal panels, 2 feet high under blackboards, 4 feet high elsewhere. Framing to be bevelled. Put cap with trough as shown under blackboards.

Sheathing.—Sheathe dressing-rooms and lavatories 4 feet high with ⅞-inch matched and beaded vertical ash sheathing, not over 4 inches wide, finished with neat bevelled cap.

Put on wainscot and sheathing before the upper floor is laid, and allow ½ inch extra below floor.

Architraves.—All doors and windows to have ⅞-inch by 4-inch plain board mitred architraves of ash, with bevelled edges.

Stool caps.—The capping of wainscot will run in to form stool cap of windows.

Doors.—Outside doors to be 6-panel as per detail drawings, 1¾ inches thick, of best seasoned clear pine, with bevelled framing, but no mouldings. All other doors to be 1½ inches thick, 6-panelled, with flush mouldings, all of seasoned pine (*veneered with ash both sides*).

All doors to have rebated and beaded plank frames of ash, and hard wood (*Georgia pine or cherry*) thresholds (*saddles*), and all doors and finish to be of the best stock and kiln dried.

Windows.—Six cellar windows to have rebated plank frames and 1½-inch pine sash hinged at top, with hook and staple to keep it open, and

iron button fastening. Make in addition two frames without sash for cold air box to furnace, and cover with strong wire netting.

All other windows to have boxed frames with pockets, hard pine or cherry beads and pulley styles, 2-inch sills pitching 1½ inches, 1¾-inch clear pine sashes in lights as shown, all double hung with good pulleys with cap over the top and galvanized face, best unbleached hemp cord and iron weights, accurately balanced. Inside beads of ash, put on with blued screws.

Wardrobes.—Fit up wardrobes with shelves, hooks on strips, shoe boxes, &c., as directed. Fit up washbowl in each, without cupboard beneath. Fit up water closets with whitewood (*tulip or bass wood*) seats to be hung with brass butts and screws and riser screwed on. Plough the sheathing into top of seat. Make earth boxes and apparatus complete as directed.

Miscellaneous.—Make cold air boxes as directed; cut holes for registers, and cut as required for plumbers and furnace men. Assist the other workmen. Make coal bins in woodshed. [Cold air boxes are best made of galvanized iron.]

Hardware.—All doors to be hung with 4 by 4 japanned acorn fast joint butts, put on with blued screws.

Outside doors to have brass face mortise lever locks; inside doors bronzed iron face, good common locks, all with plated or German silver keys (*Corbin or Nashua Lock Company's make*), and best lava knobs.

Water closet doors to have neat japanned barrel bolt in addition to lock.

Windows to have spring sash fasts, to cost $2 per dozen.

Hooks in wardrobes to be in two rows, 8 inches apart in each row, to be japanned cast iron, very stout. Heavy bulkhead doors with strong strap hinges, with staple and padlock fastening.

Painting: Outside.—Paint the roofs two coats best English Venetian red (*Rocky Mountain vermilion, Iron clad, Rossie*) paint in pure linseed oil (*slate paint, light or dark*). Paint all other outside woodwork two coats in tints as directed, touched with red as directed, using best pure lead and linseed oil. Paint sashes three coats, to finish bronze green (*white*). Oil two coats all hard wood floors and outside steps.

Inside.—Fill ash doors and interior wood work with wax and turpentine, or patent filler, and finish with two coats of shellac well rubbed down with emery cloth and oil. Puttystop after first coat; clean off all stains and leave all perfect.

Glazing.—Glaze in the best manner in lights as shown all outside sashes with first quality double thick American or German glass, back-puttied; clean off at the completion of the building, and leave all whole and perfect.

The carpenter is to clean up the building, scrub the floors, clear away rubbish, and leave the building clean.

MODEL CONTRACT.

Contract for building, made this —— day of ———, in the year ——, by and between the inhabitants of the town of Medford, in the county of Harrison and State of Texas, acting by their agent, William Smith, the chairman of the school committee of said town, the same being thereto lawfully authorized, party of the first part, and Thompson & Jones, of said Medford, builders, party of the second part.

The said party of the second part, for himself and each of his heirs, executors, administrators, and assigns, hereby covenants and agrees to and with the said party of the first part, his successors and legal representatives, for the consideration hereinafter mentioned, to make, erect, build, and finish a school-house for the said party of the first part on his land on Maple street in said Medford, including all the carpenter and mason work, excavation and grading, painting and glazing, but exclusive of furniture, and to furnish all the materials of every kind, labor, scaffolding, and cartage for the full completion of the said building, exclusive of its furniture, such work and materials to be in strict accordance with the drawings and specifications made by Henry Pratt, architect, which said drawings and specifications are to be taken and deemed as part of this contract,[1] and including all things which, in the opinion of the said architect, may fairly be inferred from such plans and specifications to be intended without being actually specified, all the materials to be in sufficient quantity, and where the quality is not described in the specification to be of the best quality, and the workmanship throughout to be of the best quality, and the whole to be executed in a good, substantial, and workmanlike manner, subject to the directions from time to time and to the satisfaction of the architect (*or superintendent*) and the whole to be completely finished and delivered on or before the fifth day of October next.

And the said party of the first part hereby promises and agrees in consideration of the foregoing covenants being strictly kept and performed by the said party of the second part, to pay to the said party of the second part the sum of two thousand five hundred dollars in two several payments as follows: One thousand dollars ($1,000) when the outside work is all done and painted one coat and the sashes in; and the balance thirty-three days[2] after the said building shall have been completely finished and delivered and accepted by the said party of the first part, unless some defect shall meanwhile have been discovered

[1] It is not necessary, though it is advisable, that the drawings and specifications should be signed; all that is requisite is that they may be easily identified.

[2] Any other number of days, but in any case postponing the final payment till a few days after the expiration of the time within which mechanics' liens can be entered against the building.

therein; provided that no payment shall be made except on the certificate of the architect or some other person thereto authorized by the said party of the first part that the work for which such payment is to be made is properly done and that the payment is due; said certificate, however, not exempting the party of the second part from liability to make good any work so certified if it be afterward discovered to have been improperly done or not according to the plans or specifications either in workmanship or materials; and provided, further, that prior to each payment by the party of the first part a satisfactory certificate shall have been obtained to the effect that the said building is, at the time when the payment is due, free from all mechanics' liens and other claims chargeable to the party of the second part.

And it is hereby further agreed, by and between the said parties hereto, that the drawings and specifications are intended to coöperate so that any works shown on the drawings and not mentioned in the specification or vice versa are to be executed by the party of the second part the same as if they were mentioned in the specification and shown on the drawings, without extra charge.

The said party of the first part or the said architect (*superintendent*), with the consent of the said party of the first part, shall be at liberty to order any variations from the drawings or specifications, either in adding thereto or diminishing therefrom or otherwise however; and such variations shall not vitiate this contract, but the difference shall be added to or deducted from the amount of the contract, as the case may be, by a fair and reasonable valuation, and the architect (*superintendent*) shall have power to extend the time of completion on account of alterations or additions so ordered, such extension to be certified by him to the party of the first part at the time when such order for alterations or additions is given. Orders for changes which do not affect the cost of the work may be given by word of mouth, but no order which increases or diminishes the cost of the work or affects the time of completion shall be valid unless given in writing.

Neither the whole nor any part of this contract shall be sublet by the party of the second part without the written consent of the party of the first part.

If the said party of the second part shall fail to complete the said works, including all variations, should such be made, at or before the time agreed upon, with such extension, if any, in the case of extra work as may have been made and certified by the architect (*superintendent*), then and in that case the said party of the second part shall forfeit and pay to the said party of the first part the sum of (*two to fifteen*) dollars for each and every day that the said works shall remain unfinished after that time, unless in the opinion of the architect (*superintendent*) such delay shall have been due to causes which could not have been reasonably foreseen by the party of the second part or with reasonable care

and diligence avoided, the same to be retained as liquidated damages out of any sums that may then be due or may thereafter become due to the said party of the second part on account of his work and materials under this contract.

All materials shall become the property of the party of the first part as soon as they are delivered on the ground.

If the said party of the second part shall become bankrupt or insolvent or assign his property for the benefit of creditors, or become otherwise unable himself to carry on the work, or shall at any time for six days neglect to do so in the manner required by the architect (*superintendent*), or refuse to follow his directions as to the mode of doing the work, or shall neglect or refuse to comply with any of the articles of this agreement, then the said party of the first part or his agent shall have the right and is hereby empowered to enter upon and take possession of the premises after giving two days' notice in writing, and thereupon all claim of the said party of the second part, his executors, administrators, and assigns shall cease, and the said party of the first part or his agent may, after using such other materials already on the ground as may be suitable, provide other materials and workmen sufficient to finish the said building, and the cost of such work and materials shall be deducted from the amount to be paid under this contract.

The party of the second part shall be solely responsible for all loss or damage to the said works or any part of them until the whole is delivered and accepted, loss by fire alone excepted; he shall keep his interest in the building at all times insured to an amount not less than fifteen hundred dollars ($1,500), and shall, if required, deposit the policy with the architect (*superintendent*) for approval and safe keeping, and shall give all necessary assistance to the other workmen employed in the building, and shall be solely responsible for all damage or delay caused to their work or materials or to neighboring property or to the persons or property of the public by his workmen or through his operations.[1]

And the said party of the first part agrees to keep his interest in the building insured against fire to an amount equal to that of the payments made on this contract until the building is delivered and accepted.

And for the faithful performance of each and every the articles and agreements hereinbefore contained the said parties hereto do hereby bind themselves, their heirs, executors, successors, administrators, and assigns, each to the other in the penal sum of one thousand dollars ($1,000) (*about one-third of the contract price*) firmly by these presents.

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[1] It saves trouble to have the party of the first part insure the whole risk, payable to him "for whom it concerns." The builder, however, may not be willing to trust him to divide the money in case of loss, and should not be compelled to do so; but as a fire while the builder's interest was uninsured would perhaps bankrupt him, causing expense and delay to both parties, he should be obliged to insure his interest himself if he is not disposed to trust the other party to do it for him.

In witness whereof the said parties hereto have hereunto set their hands and seals the day and year first above written.

THE TOWN OF MEDFORD, [SEAL.][1]

In presence of— By WILLIAM SMITH,

CHARLES HARRIS. *Chairman of the School Committee.*

EMILY THOMPSON. THOMPSON & JONES. [SEAL.][2]

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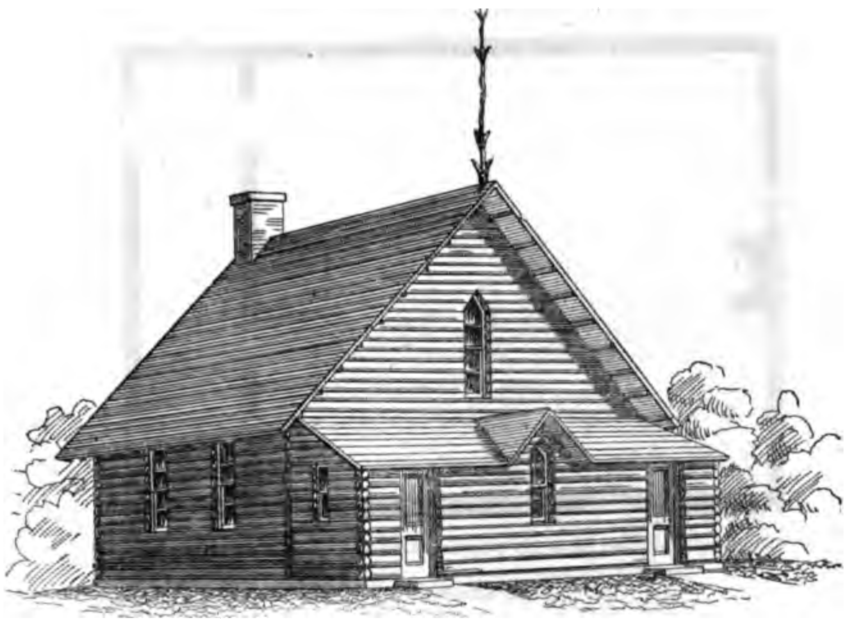
[1] The seal of the town must affixed.

[2] It is best, but not necessary, to have both partners sign. Each signature should be accompanied with a seal.

APPENDIX.[1]

The wigwam is superseded by houses built of logs before sawmills are erected in a new country. Combining, as it does, not a few excellences, this style of building deserves more consideration than it receives. There is no good reason why a well built log house should not be as comfortable as any other. Logs are non-conductors of heat. The sun does not "strike through them," as through a common hollow or any thin walled house. The timber can, in wooded regions, be had for the asking. The chopping, hauling, and construction involve more labor than the box-frame style of building, but the "money out" is less. Where labor and timber are plenty and money scarce, let there be more pains taken in erecting the building; then every advantage that is absolutely necessary may be gained. A good log house will last a generation.



The main building is 34 by 30 feet, with a lean-to of eight feet, subdivided into a teacher's room and anterooms; pitch of roof, 17 feet; projection of eaves, 3 feet; height of ceiling, 13 feet.

The construction of log houses is generally best understood by the frontiersmen who use them. The following hints may not be unacceptable to beginners:

Select timber which will last well when exposed to the weather. The logs should be 10 to 12 inches in diameter. The sills might be heavier, say 16 inches, squared, hollowed at the ends and pinned, or, better, spiked with 60-penny nails. The floor timbers are mortised with the sills and supported in centre by a bearing beam. The

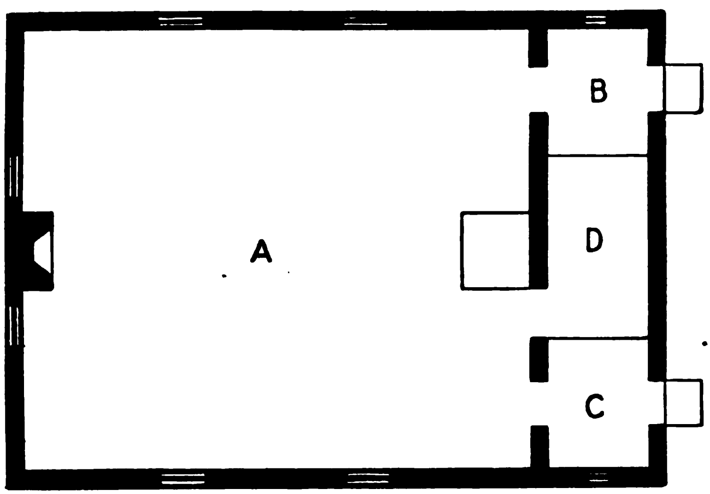
[1] From School Houses and Cottages for the People of the South, by C. Thurston Chase.

ceiling, joists, and rafters are lighter, say 7 inches. After they are up the joists may be stayed to the rafters to prevent their settling. Still smaller sticks may be used for the partitions, say 4 or 5 inches in diameter.

There are several ways of making the partitions. One is to lay the logs horizontally between two standards or upright posts at each end. Another is to plough out a groove in larger sticks, squared, say two inches deep. Set up one at each end of a partition, and for door posts. Hew down the ends of the stuff for partitions so they will fit nicely into the groove. This done, put them in their places. They should be smoothly payed on each side with stiff clay, or chinked in the ordinary way. They may also be made of tongued and grooved inch and a quarter stuff, set upright, run into grooves in a head piece above and fixed by strips nailed each side at the bottom. Let the roof project far over the sides to shield them from the storms and hot sun.

The ceiling may be covered with boards, battened, and the whole inside whitewashed. It is better, however, to lath and plaster when lime, sand, and hair are obtainable. Then, with good furniture, the establishment may well challenge our pride. On such a house not over two hundred dollars in money need be expended to accommodate 50 to 64 pupils.

The finial (the ornament on the peak of the roof) should be made of some regularly branching sapling, the limbs trimmed to even lengths.



Plan of log school-house for sixty pupils. Outside measurement, 34 by 30 feet.

DESCRIPTION OF PLAN.

Scale $\frac{1}{12}$ inch to 1 foot.

A. School room, 32 by 28 feet.
B. Boys' anteroom, 8 by 7 feet.
C. Girls' anteroom, 8 by 7 feet.
D. Teacher's anteroom, 11 by 7 feet.
Size of desks to be used, 3¾ by 2 feet.
Side aisles, 3½ feet.
Centre aisle, 2½ feet.
Rear aisle, 4 feet.

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CIRCULARS OF INFORMATION

OF THE

BUREAU OF EDUCATION.

No. 5—1880.

ENGLISH RURAL SCHOOLS.

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1880.

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CONTENTS.

LETTER.

DEPARTMENT OF THE INTERIOR,
BUREAU OF EDUCATION,
Washington, D. C., August 20, 1880.

SIR: It is well known that the deficiencies of American education are most prominent in the case of our rural schools and the most faithful educators among us are specially anxious to find means for their improvement. The great progress of elementary education in England under the education act of 1870 has caused many to seek for information as to its working in districts outside of cities; I have repeatedly sought this information in vain. Mr. Henry W. Hulbert, lately of Middlebury College, has sent me the following statement based on his personal observation and conversations with those best informed on the subject in different localities and on official reports. He does not attempt to enforce lessons from his facts, but leaves these to the reflections of the reader.

I have the honor to submit it for publication.

Very respectfully, your obedient servant,

JOHN EATON,
Commissioner.

The Hon. SECRETARY OF THE INTERIOR.

Approved, and publication ordered.

A. BELL,
Acting Secretary.

ENGLISH RURAL SCHOOLS.

During the year ending August 31, 1878, the government inspectors of public elementary schools visited 16,293 day schools in England and Wales to which annual grants were made. These contained 23,618 departments under separate teachers and afforded an average of 8 square feet each of superficial area for 3,942,337 scholars. On the registers of these schools 3,495,892 children were enrolled, of whom 1,189,557 were under 7 years of age, 2,158,179 between 7 and 13, and 148,156 over 13. On the day of inspection 2,944,127 pupils were present, and the average attendance was 2,405,197. The whole population of England and Wales is 24,854,397, and it has been estimated by the education department, after a careful examination of the question, that there should be an average school attendance of 3,500,000 children under 15 years of age. It was also estimated that 28,600 separate departments under certificated teachers were needed to furnish educational privileges to the school population; "if, however, we take into account the large number of small schools in the rural districts it would perhaps be better to take 33,000 as the measure of future requirements."

In round numbers, then, about 2,500,000 children are in average attendance upon those elementary schools of England and Wales which are inspected and receive the government grant. Besides these schools there are a limited number of the same grade scattered throughout the country under denominational and other control not reckoned in the above estimate. There are also many private schools, about which the public knows little or nothing, in which the children of the upper classes are educated. Making a final estimate from all these sources, we may infer that there is an average school attendance in England and Wales of about 3,000,000 children under 15 years of age. It is hard to tell what proportion of these are in large towns and cities and what proportion in rural districts. The education department has never made any distinction between country and city schools, and consequently there is no official information on this point. We conversed with different gentlemen on this subject, some of whom were wholly unable to make any statement which they considered worthy of trust. The statements of the others differed so widely that no definite conclusions could be reached. Mr. W. P. Williams, of the British and Foreign School Society, said that about one-half the children were in rural districts; Mr. T. E. Heller, of

the National Union of Elementary Teachers, thought about one-third, while Rev. Mr. Duncan, M. A., secretary of the National School Society, placed his estimate at one-half. The great difficulty is in distinguishing accurately between strictly rural and town districts. If the term "rural districts" embraces all districts outside of city boundaries, then the estimate of one-half is probably more correct; but if it embraces only strictly rural (farming and mining) districts, one-third seems nearer the truth. It is probable, therefore, that 1,000,000 children are in average daily attendance upon the rural schools of England and Wales. The city population of England is large and increasing, while in many parts of the country the rural districts are rapidly falling away in population. The reason why more attention is not paid to the rural schools is that the towns are large and numerous and their schools so varied and attractive as to almost entirely eclipse the generally small schools of the rural districts. As I inquired of educational men in the cities concerning them, I invariably received the reply that I would find nothing outside of the cities. But how 1,000,000 children are educated is a question of no little importance, and its examination has proved that the rural schools form a most interesting and instructive part of the educational system of England.

Since 1870 all the public elementary schools of the country, whether in towns or rural districts, have been under the same law, which law is now embodied in the several educational acts of 1870, 1873, and 1876, together with the annual codes published by the education department. The direct management of the educational affairs of England is in the hands of this education department, which has charge of the inspection of all the schools that come under the law, of the maintenance of a sufficient number of efficient schools, of the payment of all grants earned by the schools in their examinations, of the support of training colleges for teachers, and of the interests in general of public elementary education throughout the country. A detailed report is made annually, stating in full the progress of education in town and country. Thus all the educational interests of the nation are brought under the control of a school administration which has its head at Whitehall, London, and sends out its branches to even the most remote and inaccessible regions of Great Britain, carrying with it a national influence. The rural schools are thus under the same regulations as the city schools, and have the same inspectors, the same examinations, teachers from the same training colleges, the same resources for money, and the same kind of local regulating authority. This uniformity, however, is not so rigid as to allow no local coloring. A school board or an attendance committee can draw up a code of by-laws, under the sanction of the education department which will give certain liberties to the schools under their charge. The particular object of most of these by-laws seems to be to give power to the authorities to enforce the attendance of children at school. There are also special regulations for rural

districts thinly populated. "A special grant of £10 (or £15) [is made], subject to a favorable report from the inspector, if the population of the school district in which the school is situate, or within two miles, by the nearest road, from the school is less than 300 (or 200) souls, and there is no other public elementary school recognized by the department as available for the children of that district or population." [Section 19 D, Code, 1879.] Also, "150 attendances are accepted in place of 250 in the case of scholars who reside two miles or upwards from the school." [Section 20, *b*.]

These special regulations must be looked upon, however, as hindrances (perhaps necessary) rather than aids to the fullest success of the schools which they are intended to benefit. Scholars in rural districts are required to pass the same examinations as those in city schools in order to obtain the government grant, which amounts to about $4 per scholar each year. Any remissness in attendance or study has a damaging effect on the final examinations, and thus decreases the government aid to the school. It is the influence of this government grant which has brought the public schools of the country under the same sway, and every effort in the way of education seems compelled to trim its sails to this breeze from the public treasury.

All the public elementary schools of England and Wales recognized under the law are in the charge of one of two distinct bodies, viz, a school board or a school attendance committee. All schools under school boards have been either organized since 1870 or transferred to these boards by former authorities, generally denominational. Schools under school attendance committees are divided into three classes, according as they are found in (1) boroughs, (2) urban sanitary districts, and (3) unions which are made up of two or more parishes or parts of parishes. These schools, as a rule, have been in existence for many years, although some have been established since 1870 in order to preclude the possibility of a board school.

It is a difficult matter to determine how many of these different schools are to be found in rural districts. The official report does not take up the subject, and all the conversation I had with educational authorities gave me no clear light. While the truth can only be approximated, the following figures from the report of the committee of the council of education for 1879 may form the basis of an estimate:

Population of England and Wales (census of 1871).

London	3, 266, 987
223 municipal boroughs	6, 512, 611
14,094 civil parishes	12, 932, 668
Total England and Wales	22, 712, 266

Total population under school boards.

London	3, 266, 987
126 boards in 126 (out of 234) boroughs	5, 609, 840
1,807 boards in 2,618 parishes	4, 273, 392
Total in England and Wales	13, 150, 219

Total population under school attendance committees.

108 boroughs	1,266,734
69 urban sanitary districts	669,019
582 unions	7,626,294
Total in England and Wales	9,562,047

The greater part of the parishes and unions mentioned in these tables are in the rural districts of England and Wales. The figures that interest us then are the following:

	Population.
1,807 school boards in 2,618 parishes	4,273,392
582 unions	7,626,294

Of the 1,807 school boards we find 176 in towns containing over 5,000 inhabitants, and under these 176 school boards is a population of over 2,000,000. As these cannot be considered rural districts we must subtract their population, 2,000,000, from the 4,273,392, which leaves 2,273,392 as the number of inhabitants in rural districts under school boards. About seventy-five of the unions are in districts having over 5,000 inhabitants and they have a total population of about half a million. There will be left about 7,000,000 as the population of rural districts under school attendance committees. The percentage of school boards in rural districts, then, varies from 10 to 30, the remaining 70 to 90 per cent. being under school attendance committees. The vast majority of these schools are under the care of the Church of England and are called "national schools."

Schools under school boards cannot be taken as representative examples of a rural school, for they have been in existence only since 1870, having been established in accordance with the education act of that year, which sought to provide school privileges for every child in the country, and are intended only to supplement those already in existence. While in all the large towns and cities schools under this management have sprung up with astonishing rapidity, the rural districts have been very slow to adopt them, partly because there was not such a manifest deficiency in their educational advantages and partly on account of the general conservatism, which has a firmer hold upon rural districts. One gentleman (who, however, was only familiar with city schools) told me that I might take the following observation as the truth: "In the large towns and cities the people are pushing educational matters ahead as rapidly as they can, while in the rural districts they are clinging to the minimum requirements of the law."

Board schools are established in the same manner in rural districts as in towns. If on the inspection of a district the education department find that there is not sufficient school accommodation for all the children of a neighborhood, notice is sent by them to that effect. At the end of six months, unless school accommodation has been supplied, the department orders a school board to be organized. A school board may also be organized on application to the education department by the authori-

ties stating that they are unwilling or unable longer to maintain voluntarily elementary schools. If, on inspection, the department is assured that such is the fact, and that on the decline of the said schools there will be insufficient school accommodation, they may cause a school board to be established. In parishes not situated in the metropolis, these boards are elected by the ratepayers. Each elector is entitled to as many votes as there are candidates to be elected, and may distribute these among the candidates as he pleases. The board, numbering not less than five nor more than fifteen persons, thus elected for a term of three years is a "body corporate by the name of school board of the district to which they belong, having a perpetual succession and a common seal, with power to acquire and hold land for the purposes of this act (1870) without any license in mortmain." It is under the control of the education department, makes annual reports, and cannot make any extensive changes except with the sanction of the department. The clerk of this board has charge of the schools under its jurisdiction, secures teachers, regulates standards, and makes an annual report. As these schools do not differ in any important feature from the "national schools" I will defer the description of their internal workings. Board schools are supported by funds coming from three different sources: (1) Fees from the scholars, which cannot exceed *9d.* per week for each scholar and which generally vary in rural districts from *1d.* to *6d.* per week; 56.61 per cent. of scholars in England and Wales pay less than *3d.* per week; 3.07 per cent. are free.[1] (2) The government grant, which varies according to the general appearance of the school when inspected, the average attendance, passes in examinations, and the number and quality of teachers. The average grant is about 15 shillings or $4 per child. (3) Taxes, from which any deficiency that may occur is supplied. This method of meeting deficiencies, together with the religious question, has hindered the spread of board schools in rural districts. Most of the rural schools formerly under the charge of the British and Foreign Schools Society have been transferred to school boards. The fact cannot be concealed, however, that these schools are slowly increasing throughout England. During the year 1877-'78 there was a gain of 72 schools in 186 parishes and this tendency has not disappeared, but is rather developing itself. In many cases voluntary aid has diminished, school authorities have become discouraged, and schools have been transferred. As we proceed to the consideration of the supporting power of the voluntary schools we shall see how this comes about. There are not a few of the best educational authorities of England who predict a

[1] "If a school board satisfy the education department that on the ground of poverty of the inhabitants of any place in their district it is expedient for the interest of education to provide a school at which no fees shall be required from the scholars, the board may, subject to such rules and conditions as the education department may prescribe, provide such school and admit scholars to such school without requiring any fee." [Sec. 26, education act 1870.] I saw no such school; and few, if any, exist.

final extinction of voluntary schools and the complete ascendency of school boards throughout the country.[1] On reviewing the strength of the national voluntary schools we shall see, however, that such a result can only come in a very distant future, if at all. As we remarked, the great majority of schools in rural districts are under school attendance committees and are generally called national or voluntary schools. They are mostly under the charge of the Church of England. This school attendance committee is appointed by the guardians of the union parishes comprising the union. "A school attendance committee under this section may consist of not less than six or more than twelve members of the council or guardians appointing the committee, so, however, that, in the case of a committee appointed by guardians, one-third at least shall consist of ex officio guardians, if there are any and sufficient ex officio guardians." [Education act, 1876, sect. 7 (2).]

This committee can appoint local committees of not less than three persons, which shall render aid by keeping the original committee informed on all subjects connected with schools under their supervision. This local committee generally consists of the rector of the church of the parish, a prominent squire, and a leading farmer or manufacturer. The rector is the chairman, and the main support of the school or schools under his charge depends upon him. He must raise the voluntary subscriptions on which the prosperity of the school rests and provide efficient teachers, so that the school shall be presented to the government inspectors in such a condition as shall secure the maximum grant. No compensation is received for this labor. The chairman and the other members of the committee work simply for the public good. Their children do not attend these schools and consequently they can have only a general interest in them.

We shall discuss the schools under the school attendance committees in the following order: (1) Revenue, school buildings, and sites; (2) organization; (3) teaching staff; (4) instruction. Finally, after describing a few representative schools, we shall speak briefly of the sentiment in rural districts concerning education.

REVENUE, SCHOOL BUILDINGS, &C.

We have the key to rural schools when we ascertain from what sources they derive their revenue. We have mentioned that board schools receive their support from three sources, viz: fees, government grants, and rates. The other schools, mostly voluntary or national, derive their revenue from fees, government grants, and voluntary subscriptions. This latter item puts the voluntary schools largely into the hands of the church. Government grants are no longer given for the establishment of these schools. A site of from one-half an acre to an acre is generally given by some benevolent person. Money is subscribed by the wealthy patrons of the church for the erection of a building. If the

[1] Lord Derby at Liverpool.

required sum is not obtained in this way an appeal is made to the National Society for Promoting the Education of the Poor in the Principles of the Established Church. Since the passing of the act of 1870 this society has voted £116,712 ($568,387) for building and enlarging school-houses in 2,656 places. These grants have assisted in providing school accommodation for nearly 350,000 additional children. The school buildings in rural districts differ almost as much as the dwelling houses. Many of them were built years ago and their new equipments have not materially altered their external appearance. They are all modest one-story stone buildings, varying in size according to the requirements of the vicinity and accommodating schools which furnish advantages for education varying in accordance with the wealth and public spirit of their patrons and the enthusiasm of their managers. Some school-houses can hardly be distinguished by a stranger from dwellings, others are noticeable on account of their architecture and unique design. A neighboring squire perhaps takes pride in seeing a comely building adorning his fields, or a lord is anxious to give his tenantry the best educational advantages, and appropriates a sum sufficient for the establishment of a good school and perhaps adds a moderate endowment.

Many of the older buildings contain but one room, in which all the departments of the school are assembled. But, as the attendance even in rural districts is larger than in our country (varying from 70 to 200 scholars), two or three rooms should be provided. Figures I and II are model plans of rural school-houses of recent erection. Fig. I is a plan of a house designed for 48 children; but it may be adapted to any number not exceeding 96 by a proportionate increase in the length of the room and of the benches and desks, still retaining the same space between the rows and the same relative position of the doors, windows, and fireplaces. The large room for the general assemblage of the school is divided off by curtains, so that different classes or standards are separated from each other. In front is a good sized class room, which is used for separate work or may accommodate 22 children in an infant department.

FIG. I.—Front elevation.

These rooms are generally large and cheerful. The education act requires that there shall be 8 square feet of superficial area for each child, and this has been or is being generally secured. The rafters ap-

pear above, neatly painted. The windows are large and well situated. Ventilation is generally good, being provided for by two large open fireplaces, one at each end of the room, or by windows. The walls are often hung with maps and charts, and the room presents a pleasant appearance. The class rooms are well adapted to their work, having the general characteristics of the main room on a smaller scale. At the rear of the building is the playground, divided in the middle by a high brick wall. On either hand are the separate waterclosets for boys and girls, with a coal cellar between. The teacher's house is generally situated in a corner of the front grounds, and, when the school is small, is a one or two story stone or brick house, small but well adapted to its use.

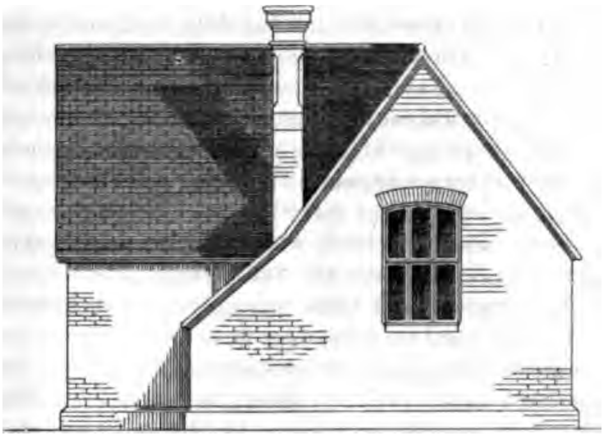


FIG. I.—End elevation.

Fig. II gives a larger schoolhouse, which will accommodate from 100 to 150 scholars. This consists, as in Fig. I, of a large main room and one class room. The playground is shown, and also the wing at the left, which is used as a teacher's house, although such a practice is not desirable. This wing is a story and a half high. The general arrangements of this building are the same as in Fig. I. The furniture of the school rooms is of the simplest kind. The teacher's desk is very plain, often nothing more than a simple table. The desks and benches for the children are generally from eight to twelve feet long, each holding from four to six scholars. The seat is a plain plank resting on rude supports, and the desks, though of the cheapest material, are well made. They are no better than the old fashioned desks commonly seen in our district schools. Of course all these details vary extremely, but the usual rural school building may be conceived of as a neat, modest stone structure, roomy, convenient, and well adapted to its circumstances. Many school-

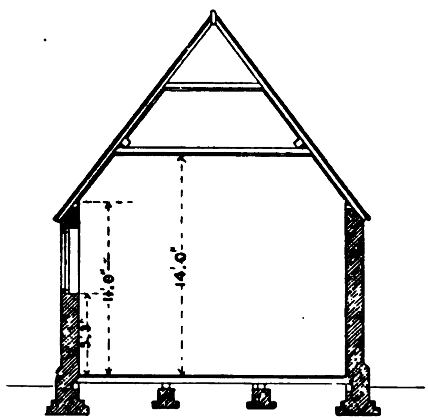


FIG. I.—Transverse section.

houses which I visited were inferior to those above described; some were over a hundred years old, and could not be expected to fulfil completely the purposes of a modern school without thorough reconstruction. In some cases I found extremely poor ventilation, but this was rather an oversight in the teacher than the fault of the buildings.

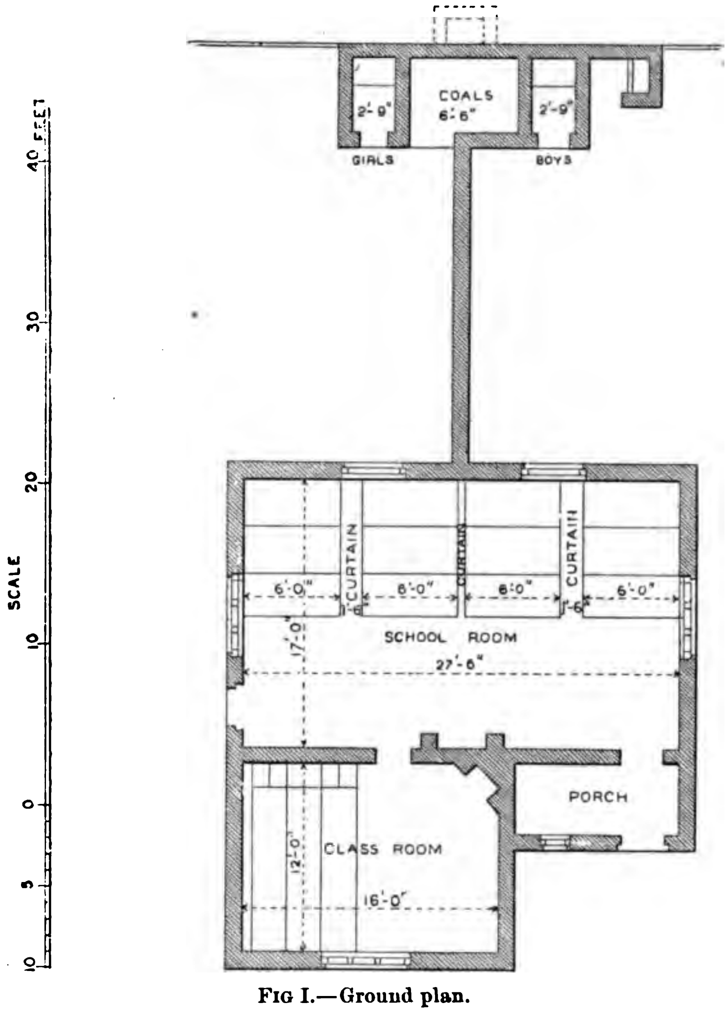


FIG I.—Ground plan.

The large fireplaces furnish ample opportunity for ventilation, and often there were ventilators over the doors. As the pupil teacher system is found everywhere in the rural districts the great majority of the schools have but one room. Many of the long low buildings formerly occupied by such schools I found enlarged by the addition of an L to each end, which furnished two convenient class rooms. The teacher's house is generally by itself, and its size depends to a large extent upon the size of the school. Its appearance is neat and trim.

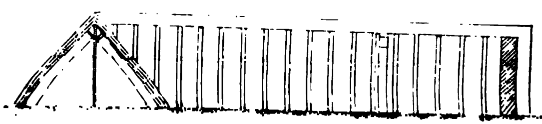
ORGANIZATION.

As stated before, the rural schools in England accommodate from 50 to 200 children each; the majority average from 60 to 125. The education of children between the ages of 5 and 13 is compulsory, with the exception of those over 10, who are allowed to work one-half of the day and attend school the other half. These half-timers are not numerous in rural districts—the law had more particularly in mind the children of factory operatives—nevertheless half-timers are found more or less throughout the rural districts, and there are not a few educationists who urge the half-time system as a solution of the child labor question. In conversation with Mr. Burrage, assistant government inspector for Warwickshire, he said: "Half-timers are not numerous in my district, and the great majority of these are boys. They are a necessary evil. As much is expected of them at the annual government examination as of children who have attended regularly. They are a source of great inconvenience and care to a teacher. At best they can be presented to the inspectors only in a poor condition. There is a great call for half-time schools, but in rural parts it is almost impossible to bring this about, in view of the expense, as well as the distance which the children would have to go." The age at which children begin to go to school in England is astonishing. In most cases I found children as young as 3, and in a few exceptional cases they were only 2½ years old. In the latter case (which was in a city) a sort of crib was furnished, and two fat, rosy children were fast asleep, and several others looked as if they ought to be there. It is a favorite idea with the English to keep boys' and girls' schools separate, and in all the cities and large towns the boys and girls in the upper classes are in different departments; but in rural districts the extra expense entirely precludes this arrangement and I found mixed schools prevailing wherever I went. As there are six standards of examination adopted by the government inspectors, there is a general sixfold division in the school, viz, standards I, II, III, IV, V, VI. The "infant department" contains the younger children and is not reckoned among the standards generally. Standards I, II, and III together form, the "junior department," and the remaining standards, IV, V, and VI, form the "senior department." There are frequently children below standard I who are not examined for the grant. The time of the annual government examination is not the same in all schools, but is arranged to suit the convenience of the inspectors.

The number of children in a standard varies exceedingly. The lower standards are generally full, while the upper dwindles down in some cases to four or five. Forty children in one class are generally considered enough for one teacher, but this number is often exceeded. As we have seen from the plan of the school buildings, many of the classes may be heard at the same time in the same room. This is often done, although it is becoming very common to have one or two class rooms, as

FIGURE II.

Front elevation.



confusion more or less noticeable is occasioned by the simultaneous recitations of two classes in the same room. I often found 100 or 150 children in one room. Upon entering a room you notice the managing teacher at work with some class, at the same time keeping a watch over the whole school. The pupil teachers are scattered around the room, hearing classes, correcting examples, writing, &c. A printed programme is always provided, so that every one may know what is going on in different parts of the school. The school hours are from 9 to 12 and 1.30 to 4.30; 2 hours is all that the government requires for one half day session. The rest of the time is occupied in religious teaching, for which there is no grant and from which a parent can withhold his child under the provisions of the "conscience clause." There must be 400 of these half day sessions during the year. There are generally 45 weeks in the school year, leaving only 7 weeks of vacation: 2 at Christmas, 1 in May, and the remainder, with the exception of a few holidays, in midsummer. The government grant varies according to the attendance and the passes in the annual examination. The following shows the grants to day schools. The average number in attendance for any per od is found by adding together the attendances of all the scholars for that period and dividing the sum by the number of times the school has met within the same period; the quotient is the average number in attendance.

The following sums per scholar are paid to a school which has met not less than 400 times according to the average number in attendance through the year:

A. (1) 4*s*.; (2) 1*s*. if singing forms part of the ordinary course of instruction; (3) 1*s*. if the inspector reports that the discipline and organization are satisfactory. From these sources 6*s*. per child may be obtained.

B. Every scholar present on the day of examination who has attended not less than 250 half times, 150 morning or afternoon meetings of the school, brings to the school the following sums: If between 4 and 7 years of age at the end of the year 8*s*. or 10*s*., according to the kind of class, without examination; if more than 7 and subject to examination, 3*s*. for each pass in reading, writing, or arithmetic, or 4*s*. for each such pass in an infant school or department.

C. The sum of 2*s*. (or 4*s*.) per scholar, according to the average number of children above 7 years of age in attendance throughout the year, if the classes from which the children are examined in standards II–VI, or in specific subjects, pass a creditable examination in any one (or two) of the following subjects, viz, grammar, history, elementary geography, and plain needlework; only 1*s*. (or 2*s*.) to be paid unless 15 per cent. of the scholars examined are in standard IV and upwards.

D. A special grant of £10 (or £15) subject to a favorable report from the inspector, if the population of the school district in which the school is situate, or within two miles, by the nearest road, from the school is less than 300 (or 200) souls, and there is no other public elementary

school recognized by the department as available for the children of that district or population.

E. The sum of 40*s*. (or 60*s*.) in respect to each pupil teacher who passes fairly the annual examination.

F. The school fees of children who hold honor certificates (earned by examination before 11 years of age) are paid by government.

TEACHING STAFF.

The recognized classes of teachers are: certificated teachers, pupil teachers, and assistant teachers. Lay persons alone are recognized as teachers in elementary schools. These certificates are obtained by examination and after a probation of actual service in school. The examinations are held in December of each year. They are open to candidates who have resided for at least one year in training colleges under inspection, or candidates who are upwards of 21 years of age and have either completed an engagement as pupil teacher satisfactorily, obtained a favorable report from an inspector, or served as an assistant for at least six months in a school under a certificated teacher.

Candidates for certificates, after successfully passing their examination, must, as teachers continuously engaged in the same schools, obtain two favorable reports from an inspector with the interval of one year between them. The certificates are of three classes. No certificate is originally issued above the second class. The third (lowest) class includes special certificates for teachers of infants and of small schools. Candidates passing the best examinations receive certificates of the second class, which can be raised to the first class by good service only. Certificates of the second class remain in force for ten years from the date of their issue, after which interval they are open to revision according to the intermediate reports. Candidates who pass the poorer examinations receive certificates of the third class. They are not entitled to have charge of pupil teachers. They can obtain higher certificates only by examination. The following particulars are to be noted, especially in the study of rural schools: Certificates of the third class may be granted without examination, upon the report of an inspector, to acting principal teachers who satisfy the following conditions: (1) They must at the date of the inspector's report (*a*) be above 25 years of age, (*b*) have been in charge of elementary schools for at least five years, and (*c*) present certificates of good character from the managers of their schools. (2) The inspector must report (*a*) that they are efficient teachers; (*b*) that not less than 20 children who had been under instruction in their schools during the preceding six months were individually examined; and (*c*) that at least 15 of the "passes" of these scholars in reading, writing, and arithmetic were made in the second or some higher standard. (3) No application for certificates of this class will be entertained after March 31, 1881.

In schools having a total population of less than 100 souls within 3

miles of them, for which no other school is available, the above conditions under (2), (*b* and *c*), and (3) are not required to be fulfilled. Under certain conditions of excellent attainments pupil teachers may obtain provisional third class certificates, to be exchanged for permanent certificates on or before reaching the age of 25.

Pupil teachers are boys or girls employed in day schools under certain conditions. The school must be under an efficient teacher, properly organized, &c. These pupil teachers must not be less than 14 years of age, of the same sex as their contro ling teacher, and pass a satisfactory examination on engagement and at the end of each year. Not more than three of these teachers are engaged in a school for every certificated teacher serving in it. These pupil teachers do not teach through the whole day, but study and recite to the head master or mistress during a portion of the day. Where more than three pupil teachers would be needed, children over 12 years of age may be employed as monitors under certain conditions. They are engaged by the week, are employed only 3 hours a day, and are paid a small sum. The usual time spent by a child as a pupil teacher is five years, each year adding to the salary. At the close of their engagement they are perfectly free in the choice of their employment. If they wish to continue in the work of education they may become assistants in elementary schools or may be examined for admission into a training college or may be provisionally certificated for immediate service in charge of small schools.

Assistant teachers are recruited both from the ranks of the pupil teachers who have finished their engagements and from candidates who have passed the required examination. These need not be annually examined as in the case of the pupil teacher.

These three classes of teachers are then found more or less in all rural schools. A school of 60 or more scholars requires besides the head master or mistress some other assistant or assistants according to the number of pupils. Fully 75 per cent. of the heads of rural schools are mistresses, for the simple reason that they can be had at less expense than masters. In all England and Wales there is a corps of about 25,000 certificated teachers of elementary schools. The training colleges accommodate 3,194 and furnish yearly a supply of 1,500 teachers who have been trained for two years. This number is sufficient to supply the annual loss of about 6 per cent. Since 1870 a great and beneficial change has taken place in the social condition of teachers; their salaries have been materially increased and their manner of life has been rendered more comfortable. This has had the effect to attract great numbers into the profession. The void that once existed will soon be completely filled. Teaching is exclusively a profession throughout Great Britain and when once taken up is generally prosecuted through life. The following table from the report of 1879 gives a summary of the average salaries.

Male teachers certificated.

Amount received	Under £50	£50–75	£75–100	£100–150	£150–200	£200–250	£250–300	£300+
Number of teachers	129	1,125	3,215	4,904	1,442	498	183	99

Female teachers certificated.

Amount received	Under £40	£40–45	£45–50	£50–75	£75–100	£100–150	£150–200	£200+
Number of teachers	709	813	740	7,176	3,481	1,451	241	40

The average salary of masters in 1870 was £95 12*s*. 9*d*., and is now £118 14*s*. 3*d*.; that of mistresses in 1870 was £57 16*s*. 5*d*., and is now £71 2*s*. 2*d*.

Five thousand and eighteen out of 14,651 mistresses and 5,369 out of 11,595 masters had the use of furnished houses.

These figures prove better than anything else, perhaps, the increased respectability of the teaching profession in England. The certificated masters generally seek positions in the cities and large towns, and consequently the estimate that 75 per cent. of the teachers of schools in the rural districts are mistresses is not too large. The following quotation from the report of Her Majesty's inspector Rev. H. A. Pickard, M. A., for the Oxford district, a rural region, gives some idea of the workings of school affairs. He says:

The teachers in these schools differ widely in ability. During the last four or five months I have been taking pains to ascertain some particulars about the training of those who have charge of schools in my district. In that time I have seen 145, viz, 61 masters and 84 mistresses. Of the masters 44 had been trained, 17 were untrained; * * * Of the mistresses 33 had been trained, * * * while 51 had had no training and 31 had not even been pupil teachers. From this the conclusion may be drawn that there is a great variety in the quality of the instruction given. So also is there considerable difference in the salaries which the teachers receive. * * * I have kept the returns of the salaries given by the managers in 264 out of the 308 departments that I have visited, and I find the average to be of 113 masters, £109 11*s*. 11*d*.; of 107 mistresses, £62 11*s*. 7*d*.; and of 44 mistresses of infant schools, £55 7*s*. 9*d*.

There were 658 free scholars in his district. The larger salaries attract the more ambitious teachers to the cities, and yet I was informed by Mr. Heller, of the National Union of Elementary Teachers, that many of the best teachers are to be found in rural schools. All the teachers, irrespective of the places in which they teach, must go through the same training and submit to the same discipline. The educational results in rural districts are often better, he thought, than in the towns and cities. The staff in a small school must be inexpensive in proportion to the number of scholars. There must be as many grades as in larger schools. The teacher often profits by the greater struggle to fit all his scholars for examination. The tendency of the best teachers, he said, was to seek the most lucrative places in the towns. Yet the cost of living was less in the country, a pleasant house was furnished (which is very rarely the case in the city), and numerous other advantages were held out by rural schools.

INSTRUCTION.

The course of instruction in the strictly rural districts is limited compared to that of the larger towns and cities: reading, writing, arithmetic, elementary grammar, geography, history, and sewing. With each school there is a sewing mistress, who instructs the girls once a day generally, and these are examined at the close of the year as strictly in this branch as in others. Children are not compelled to attend school after they arrive at the age of 13, and few attend longer. The course is divided into six years, which are called the six standards. The infant department is not included in these standards. At the close of the first year first standard scholars are examined as to their ability "to read a short paragraph from a book not confined to words of one syllable," "to copy in manuscript character a line of print on slates or in copy books at choice of managers, and write from dictation a few common words," to understand "notation and numeration up to 1,000, simple addition and subtraction of numbers of not more than four figures, and the multiplication table to 6 times 12." The second standard is expected to make a slight advance in these subjects, and to be able "to point out the nouns in the passages read or written," and give the "definitions, points of compass, form and motions of the earth, and the meaning of a map." The fourth standard is expected "to read with intelligence a few lines of prose or poetry selected by the inspector," to write "eight lines slowly dictated once from a reading book, copy books to be produced showing improved small hand," to understand "compound rules (money) and reduction (common weights and measures), parsing of a simple sentence, outlines of the geography of Great Britain, Ireland, and colonies, outlines of the history of England to the Norman Conquest." The vast majority of children in the rural districts never get beyond the fourth standard. The sixth standard is expected to pass examination on the following subjects: "Reading with fluency and expression—short theme or letter—the composition, spelling, grammar, and handwriting to be considered; proportion and vulgar decimal fractions, parsing and analysis of a short 'complex' sentence, outlines of the geography of the world, outlines of the history of England from Henry VII to the death of George III." This may be considered the maximum of learning that may be acquired in the rural elementary schools, and as there are no high schools to be found outside of the towns, rural children go no further. Night schools used to supply the deficiency between elementary schools and the higher schools, but these are being slowly eliminated. They receive no government grant except for the three R's. It will be noticed that one standard advances but a very little on the one below it. As the children, bright or dull, are held in the same class, it is some disadvantage to the bright ones, who could master the requirements in a fraction of a year. The teachers bring the government grant to their school by seeing that *all* the scholars pass the examination. The following quotation from a very

interesting and exhaustive report by Mr. George B. Davis, clerk to the Birmingham school board, on "schools in Germany and Switzerland," in which he speaks of English schools, is a forcible and careful statement of the dangers and difficulties of the case. He says:

It is easy to understand that when people are paid for certain specified results, the work which is paid for will receive most attention; and if that work requires great and concentrated effort and taxes the energies to any considerable extent the work which is not paid for is sure not to receive a very great amount of care. This has been the position of our teachers to an extreme extent. The elementary education acts have had the effect of forcing into the schools thousands of children who never went to school before. It has required hard work to bring many of these children up to the standard of the minimum examinations, and this has been made worse by the fact that in many of our schools money has not been forthcoming to provide the masters with a strong staff of assistants. It is, therefore, not at all surprising that the teachers should have turned their attention mostly to the dunces in order to prevent a loss of grant. It is easy to see, too, how the minimum requirements have naturally come to be regarded in many schools as a complete syllabus and to be treated as a maximum. A chief difference in the effect is that in their natural eagerness to get "passes" our teachers are tempted to resort to all kinds of contrivances for coaching children on the exact lines of the examinations, and one of the first things many teachers do when they remove to new schools is to endeavor to ascertain the very methods of examination adopted by the inspectors of the district, so as to make the teaching conform to the mode of examination. Thus the teaching becomes extremely mechanical, and examination rather than education is the thing worked for. This is a mischievous state of things which it will be difficult to cure, especially while the teachers are compelled to work for "passes" and for grants. The German teacher, on the other hand, is taught to enter on his work as an educationist. * * * The minds of the children are being constantly influenced and developed by the mind of the teacher.

If the above remarks are applicable to English schools in general, they are particularly applicable to rural schools, where, as I was everywhere informed, educational matters are not pushed with zeal; where teachers are ill paid; where the schools are at best but poorly manned, and the teacher has every disadvantage to struggle with. And still there has been very commendable progress in rural schools within the past ten years. Mr. Heller, although admitting that the minimum scale is largely adopted in rural parts and that the education acts are a dead letter in many sections, looked upon the rural schools as being nearly on a par with city schools—the teachers are similarly trained and the grants nearly equal. He hinted, however, that there might be a possibility of a greater degree of leniency adopted by the inspectors of rural schools.

The methods of instruction have already been indicated in the arrangements of the school buildings and the quality and number of teachers. As you enter an average rural school, with one large room and a class room adjoining, the scene seems a little complicated until you are told the plan. You see the head master instructing a class of older boys in arithmetic. He writes the examples on a small transportable blackboard, and the pupils work them out on their slates or paper. Over in one corner you see a boy about 15 years old silently passing from seat

to seat inspecting examples in arithmetic which have been previously worked. You are struck with the appearance of so young a person as a teacher. He does not have the full charge of any one class, but is working under the direction and immediate superintendence of the head master. In another section of the room is an older boy who has been a pupil teacher for a longer period. He is hearing a reading class and is less under the care of the head master. He has full charge of this class. Glancing into the class room you see the "infant class" under the charge of a mistress. It is seated in a sort of gallery, tier rising behind tier. Or perhaps the girls are being instructed by their sewing mistress, and are all busy with thimble and needle or with knitting. Everywhere you find that the schools are noisy in comparison with similar ones in America. The lower standards are the largest, and their size lessens as their requirements increase. Sometimes the higher standards are so small that the IVth, Vth, and VIth are combined in one class, and that a small one.

TYPICAL EXAMPLES OF RURAL SCHOOLS.

It is a difficult matter to embrace in a few examples all the varieties of rural schools to be found in England. I will mention two which I visited during September and October, 1879. The first was in the small village of Grasmere, among the mountains of Westmoreland. This village is situated in a parish containing 1,000 inhabitants, mostly small farmers who turn their attention to the rearing of sheep. The village itself is a much frequented summer resort and many of the inhabitants keep summer boarders. The school-house is a neat building, one story high, with a plan much like Fig. II, with the exception that the wing on the left is similar to that on the right and is devoted to school purposes. The teacher's house is a separate building. The interior showed the plain, substantial taste that characterized the exterior. There was no ceiling, well finished rafters being left in sight, and the walls were plain white, decorated with various maps, blackboards, &c. The desks were very plain, being long common benches with simply a board for the seat. The school furnished accommodation for 175 scholars and had an average attendance of 108. The school begins its year immediately after the government inspection in May. The term lasts until the third week in July, then a vacation of four weeks. The next term opens on the second week in August and continues until Christmas, when there is a vacation of two weeks. With the exception of a few days at Easter, there are no more vacation days during the year. This school is a "national school," and connected with the church. The rector of the parish is the chairman of the local committee; he is associated with two or three farmers. The school hours are from 9 A. M. to 12, and from 1.15 P. M. to 4.15. As this school receives the government grant, the religious exercises do not come during the school hours, but after. The boys and girls are mixed in all the departments, and made an excellent appearance as they worked

busily upon the common studies. The government grant for the past year was £77. The children pay as fees 4*d.* per week, except 5 who are elected annually as recipients of free tuition and 15 who pay 2*d.* per week, the remainder being made up from the income of a foundation charity which amounts to £21. The head master receives a salary of £105 together with his house and coal. He also receives £25 as organist of the church. He has under him pupil teachers whose salaries begin at £12 10*s.* and rise £2 10*s.* each year. He has also a monitor who receives £10 a year, and an infant teacher and sewing mistress whose salary is £55 a year.

Grasmere has had a good school for over 100 years and is as well educated as any section in rural England. The present school has been in existence for more than a century and has been a national school since 1854, at which time the present building was erected. The percentage of adults who can neither read nor write is very small, not over 5 at the maximum. As before stated, the chief occupation of the inhabitants is sheep raising. Some farmers have from 2,000 to 4,000 sheep, and raise a little corn, some oats, a good many potatoes, and a few cattle. The families are all large, the children numbering from eight to twelve. The recent education acts have had a marked effect even in this remote district. The interest of the people at large in educational matters has increased, the children are more regular at school, and the education they receive is more thorough. One injurious effect that has resulted is that children leave school earlier than formerly. At the age of 13 they get their certificates and this puts an end to their study. There are very few children at school over 13 years of age. In this region there is no high school, and consequently no opportunity for a poor boy to rise to the university.

The next example I take is of a national school in the little village of Rowsley, Derbyshire, which contains but 250 inhabitants, mostly small farmers, railroad men, and quarrymen. The school is a small one, having 110 names on the books, 86 being in average attendance. The school building is a neat stone structure, but very old. The teacher's house is joined to the rear of the main building. The single schoolroom is plainly yet substantially furnished, well ventilated, and cheerful. The Duke of Rutland keeps the buildings in repair at his own expense. The children are from 3 to 16 years of age, although the majority leave school at 13. The six standards are taught, and a few scholars pursue their studies still further. These latter are increasing every year. As there are no higher schools in the vicinity the education of the poorer children must stop here. The village is a prosperous one, and its inhabitants generally have a bit of land and keep one or two cows, only a few being very poor. There are no foreigners and few adults who cannot read or write. The education act has brought educational matters to the front and the people are showing a greater interest in them.

The school facilities are better and a higher standard is maintained. There has been only one defaulting parent since 1876, and there is but one half-timer. The head master receives £100, his house and his taxes. His wife has charge of sewing, and one pupil teacher assists him, receiving 2*s.* per week. The head master is also postmaster, organist, and choir master. To show how great have been the changes for the better, I will quote a report that was made on this school in 1873 by a government inspector. He says:

This school is in a thoroughly inefficient state. I have seldom seen one more so. There are scarcely any suitable books or apparatus, and only one small privy, common to boys and girls. Plans for the improvement of the offices have been returned by the education department to the managers. I was informed these plans had been lost. Nothing has been done in the way of improvement. The late master, Mr. Parr, evidently neglected his school. The present teacher resides four miles from the school, but I believe this is a temporary arrangement. No grant is payable, as the regulations of the 7th section of the elementary education act have not been put up in the school room.

Such was his report, and I was also informed that at that time the average attendance was but 28, the number present at the government examination was only 5, and of these only 2 passed in reading, and none in writing and arithmetic. The teacher was an ex-blacksmith who had smashed his thumbs and taken up the teacher's vocation as a last resort. His predecessor was an ex-grocer. When we contrast this state of things with the present we see how fundamental are the changes for the better which are being brought about all over rural England. This is probably an extreme case and should not be taken as a type, yet it shows the great lethargy into which public interest in vital subjects can fall. The present teacher is a graduate of a training college. The school is equipped in a thorough manner, all the children in the neighborhood are at school, and everybody is interested in educational matters.

In his annual report for the Oxford district (which is a rural one) Her Majesty's inspector, the Rev. H. Adair Pickard, M. A., makes a few statements which bear upon the subject in hand. He says:

Out of a population which amounted at the last census to 181,060, I found 24,477 children in school and I should think there was accommodation for about 6,000 more. Indeed, in almost every school district sufficient efficient and suitable schools are now provided for the children of the poor, and generally the parents are ready, at considerable sacrifice for the present to themselves, to take advantage of the instruction thus offered. Out of the 308 departments there are no less than 185 single schools, many of them very tiny, and deriving great advantage from the grants paid to the managers when the population of the school district does not exceed 200 (or 300) souls. Thirty institutions have two teachers, 18 being mixed under a master, with a certificated teacher for the infants; 3 under 2 mistresses, one of whom takes the infants; and 9 of the objectionable class where the master takes the boys, of whom many are under 7 years old, and the mistresses the girls, with an equal tail of infants. There remain 21, chiefly in towns, where the school is organized in the best manner possible, with three departments of boys, girls, and infants. In one village, Churchill, the children are taught in this manner, and, though it is a costly plan, yet the managers have their reward in the excellence of their schools. * * * Twenty-one night schools were

examined at 14 centres, * * * 396 young people were qualified for examination, of whom 357 were examined, and they gained 305 passes in reading, 263 in writing, and 242 in arithmetic.

SENTIMENTS CONCERNING EDUCATION IN RURAL DISTRICTS.

This topic has been touched upon many times in the foregoing statements, and yet some further remarks on so important a theme may not be uninteresting. Mr. Heller of the National Union says:

The recent agitation of educational subjects has made great changes in the character of the people. The great cry that advanced education would increase the crime of the land has been thoroughly answered. Crime has been rapidly on the decrease since the education acts have become the law of the land. There is manifestly less coarseness of manners among the lower classes. The desire for education, it is true, has led to a certain restlessness. It has driven children into towns to seek what they consider higher situations, and in some cases it has led to emigration. Educational questions have become popularized. Where one thought on such subjects, eight are interested now.' One harm has resulted: the working classes have been partly led and have partly fallen into the habit of regarding education as only a means by which they can get higher wages. Unless they can see the practical issue of the subjects taught they are inclined to murmur. In many cases where the teacher is pressed for time, having insufficient assistance, where his pay or reputation depends on the amount of the grant earned, simply the minimum requirement is kept in view, and the teacher turns his attention to the bare facts to be taught which will enable the scholar to pass the examination. This press crowds out all opportunities on the part of the teacher to show how the studies are related to their everyday life. There is a great call for technical schools which will give special instruction on practical subjects.

Mr. Burrage, of Warwickshire, said:

The great question with the farmer is how he can educate his children and yet get all the work possible out of them. The matter rests in the hands of the clergyman and one or two leading farmers. Now when better educational facilities have a lukewarm support, when the farmers are inclined to pull back, it is hard work to establish and keep in good order efficient schools. The half-time system can only be a success where there are special half-time schools, and the night schools are being discouraged by the education department, and yet on the whole great advances are being made in public sentiment concerning elementary schools. There is little or no opposition to the compulsory system, and where it is not carried out strictly it is rather from neglect than from direct opposition.

The education acts have been in existence hardly long enough to have affected materially the industries of the country, but the next ten or twenty years will show the results of the seed already sown. All parties look forward to a greater or less increase of board schools throughout England. This great system of unsectarian education, not necessarily excluding teaching in religious subjects, is slowly modifying and adapting itself to the needs of the English people; whether it shall ever become universal or not, it has stirred up the public sentiment to a fervent heat on a subject of great national importance.

CIRCULARS OF INFORMATION

OF THE

BUREAU OF EDUCATION

No. 6–1880.

A REPORT ON THE TEACHING OF CHEMISTRY AND PHYSICS IN THE UNITED STATES, BY FRANK WIGGLESWORTH CLARKE, S. B., PROFESSOR OF CHEMISTRY AND PHYSICS IN THE UNIVERSITY OF CINCINNATI.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1881.

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APPENDIX.

LETTER.

DEPARTMENT OF THE INTERIOR,
BUREAU OF EDUCATION,
Washington, September 20, 1880.

SIR: The following special investigation into the opportunities for instruction in chemistry and physics in this country, including the statistical tables of the appendix, was prepared about the beginning of the year 1880 by Prof. F. W. Clarke, of the University of Cincinnati. I recommend that the paper be published as a circular of information.

Very respectfully, your obedient servant,

JOHN EATON,
Commissioner.

The Hon. the SECRETARY OF THE INTERIOR.

Publication approved:

A. BELL,
Acting Secretary.

INSTRUCTION IN CHEMISTRY AND PHYSICS.

CHAPTER I.

GENERAL INTRODUCTION.

Towards the close of the year 1878, the Commissioner of Education sent out a circular containing questions relative to the teaching of chemistry and physics in the United States. Those questions were exceedingly comprehensive. They covered the ground from the most elementary work of the common schools up to the highest courses of the universities. The history of instruction in chemistry and physics, the present courses of study, the text books used, the value of apparatus, the laboratory facilities and policy, the character of examinations, and the cultivation of original research were all made subjects of inquiry. Later a supplementary circular was issued covering much of the same ground but especially addressed to superintendents of public schools in the larger towns and cities.

Gradually answers came in, and in due time the voluminous material thus collected was placed in the hands of the present writer for discussion and report. The replies varied much in value, so that great care had to be taken in compiling both the text and the statistical tables. Some questions were answered fully, others vaguely; some schools were careful and interested in filling out their replies, others were indifferent and careless. Such replies to single questions as were unmistakably ambiguous have been rejected altogether in making up this report; in other words, have been regarded as no replies at all. In short, the usual critical methods have been employed in the selection of good and the rejection of bad material. One set of answers has been left almost entirely out of consideration, namely, those relative to examinations. They were full enough in many cases, but, resting unfortunately upon no common basis, were in no way fairly comparable, and indicated nothing of value as to the character of instruction given. Details concerning the other classes of replies will be found in the explanatory notes preliminary to the statistical tables.

The purpose of the report is twofold: first, to state the facts, and, secondly, to point out defects and remedies—to show on the one hand what is, and on the other what ought to be. The bulk of the work is occupied, as will be seen, by text descriptive of single institutions and by statistics of a general character. In these portions of the report no criticisms are introduced. Every school or college is given for what it

is worth; and a fair account is presented, showing, as far as the reports sent in would warrant, just what it is doing in physics and chemistry. If the reports have been inexact or incomplete, if some schools have claimed too much and others too little, the fault lies not with the present writer.

In the prefatory portions of each descriptive chapter, various general considerations are offered and criticism is freely indulged in. This criticism is in no case, however, applied to single institutions. It attempts to compare the actual state of things with the condition which should properly exist; and, in doing so, it clearly and sharply indicates current defects and evils. The distinct recognition of faults is plainly the first step in any process of reform. When it is supplemented by the perception of merits, then progress becomes not possible merely but almost certain. The views which the writer has put forward are, he believes, those which are to-day held by the greater number of specialists in physics and chemistry and are not merely his own personal notions. Upon one point, however, two schools of scientific teachers are in opposition; and here he has been compelled to choose sides. On the one hand it is believed that a full course of didactic instruction should precede the admission of students into the laboratory, and on the other it is held that laboratory and classroom work should go side by side from the beginning. The writer holds strongly to the latter opinion, and believes that much teaching of science preliminary to laboratory practice is like lectures upon swimming before the pupil enters the water. Just as the student of Latin takes grammar, exercises, and translations side by side, so the learner of a science should simultaneously acquire and apply his knowledge. To study chemistry without laboratory practice is like trying to learn mathematics by rule alone, apart from discipline in the solution of problems. Every branch of knowledge should be so taught that the pupil may catch some of its real spirit, something of that feeling which animates and encourages the foremost investigators, and which alone is able to cause a vigorous growth. To this end, in every natural or physical science some objective work is absolutely essential, and the schools which fail to recognize this fact can never attain to the desired results. The sciences, from an educational point of view, have merits of their own unlike those of other studies. They are intended not only to give mental discipline, but also to train the faculty of observation and to teach the scholar the experimental method of grappling with unsolved problems. To accomplish these purposes the student of botany collects and analyzes plants, the young naturalist picks up and classifies shells and insects, the beginner in chemistry tries simple experiments. Without the latter, the study of chemistry can never be anything but a failure; and the writer holds that it should begin at the very outset, if for no other reason than that so many pupils quit their lessons before reaching advanced work.

Two difficulties, partly real and partly imaginary, have hitherto op-

posed the general introduction of laboratories into the schools. One has been the difficulty of finding trained teachers or teachers with whom science was not subordinate to other things; the second arises from considerations of expense. The first difficulty, as will be shown in subsequent chapters, is real enough, although it is rapidly dying away; the other rests on the flimsiest of foundations. Let any one who thinks that laboratories are necessarily costly once see how much a boy can accomplish for himself with a few test tubes, bottles, and cheap reagents, and his ideas upon this subject will undergo essential modifications. This matter is sufficiently discussed in the following portions of the report, but there is one practical consideration which may be properly presented here.

Some years ago, Congress passed an act authorizing schools and colleges to import apparatus free of duty. This act is not so widely known among teachers as it ought to be, nor do those who know it fully realize the saving in expense which it implies. Goods bought of a local middleman cost their European price, plus a heavy duty and the expense of transportation, with a large profit to the dealer over and above the sum of the foregoing items. A school, by importing its apparatus directly, can save the duties and the local dealer's profit—a retrenchment of from forty to fifty per cent. A hundred dollars thus expended on a direct foreign order will buy as much material as a hundred and fifty laid out at home. A knowledge and an application of these facts will enable many a school to do far more in the way of laboratory work than is considered possible now. To be sure, it is desirable that home trade should be patronized, but not in such a way as to cripple science. The present duties bring in but a trifling revenue to the government and might be abolished without injury to any one. If this were done, our schools and colleges could afford to buy more goods of American dealers; the latter, with larger sales, could ask more reasonable profits; and so both buyer and seller would be benefited.

One of the useful features of this report is that it renders possible a comparison of the work done in chemistry and physics by schools of diverse grades. Especially interesting is the parallel to be drawn between the colleges and the preparatory schools. In most cases the latter teach chemistry and physics to the same extent as the former and in essentially the same way. The conclusion is obvious that the colleges ought to do higher work; and, as far as courses of study leading to the B. S. degree are concerned, they should add the sciences in question to their requirements for admission. The present repetition or duplication of studies is clearly wasteful, and ought to be abolished. A little more coöperation in this matter between the lower schools and the colleges would plainly be advantageous. Let the schools uniformly put these studies into their upper grades, while the colleges bring them regularly forward into the freshman year, and a direct progression would be readily attainable. In some places this is done, but not in many. As a

rule, the ordinary college course leaves the sciences for the junior and senior years, an arrangement which precludes the coöperation suggested above and renders advanced electives in either chemistry or physics out of the question.

CHAPTER II.

HISTORICAL SKETCH.

The sciences of chemistry and physics are of such comparatively recent origin that their educational prominence is altogether a growth of modern times. The present century has seen their chief developments, and within the memory of men still living they have leaped from a wholly subordinate position into the front rank of the greater studies. Fifty years ago no college in America would have given chemistry an equal rank with Greek; to-day an election between the two subjects is in many of our best institutions freely permitted. In these sciences especially, useful in so many arts and industries, powerful in intellectual methods, and fertile in suggestions for the imagination, the classics find their strongest rivals for educational supremacy.

The early history of scientific teaching in America is vague and obscure. Before the war of the Revolution, natural philosophy, such as it was in those days, had a sort of footing in American colleges. The character of the teaching may easily be guessed. The subject was usually subordinated, as it still is in some institutions, to the study of mathematics. Lectures were delivered upon mechanics, hydrostatics, pneumatics, and optics; a little was said about heat and sound; a few experiments in electricity were perhaps occasionally shown. Experimental physics was then but just beginning to develop; Rumford was yet to interpret the nature of heat; the electric current was unknown; Oersted, Ampère, Davy, and Young were not even born. Oxygen was still an undiscovered substance. Priestley and Cavendish, Scheele and Lavoisier, Dalton and Gay-Lussac had all their work yet to do. There were no physical laboratories for the instruction of students anywhere; instruments of precision were scarcely thought of; and chemistry, except as an obscure and almost unimportant branch of physics, was hardly taught at all. The sciences were young and feeble, and good methods of instruction in them were yet to be evolved.

By slow degrees the study of chemistry was introduced into American medical schools and colleges. In the former class of institutions it was taught at first in connection with materia medica. The University of Pennsylvania medical school in 1768, the medical school of Harvard College in 1782, and the Dartmouth school in 1798 are among the places at which the science was early recognized. The colleges proper were perhaps somewhat slower in extending their hospitality to the new branch of learning. At William and Mary there was a professor of

chemistry and natural philosophy as early as 1774; but Princeton was the first academic college to award to chemistry the honor of a separate chair. Here, in 1795, Dr. John Maclean became professor of chemistry, but at a later period the labor of instruction in mathematics and physics was also assumed by him. The lead thus taken was followed by Columbia College in 1802; by Yale, in 1803; by Bowdoin, in 1805; by South Carolina College and Dickinson College, in 1811, and so on by college after college until chemistry was recognized as an important branch of study all over the land.

Between 1800 and 1845 scientific studies grew slowly but surely into favor. This was the preparatory era which led up to the establishment of our modern technological schools, the first of these being the Rensselaer Polytechnic Institute, founded in 1824. During this period many illustrious men were making their best researches, and enthusiastic students were bringing to our shores the traditions of laboratories abroad. Hare and Silliman, Page and Henry, gave discovery after discovery to the world; and Liebig, at Giessen, was training many a future professor for American schools. Here and there at home, chemists opened their private laboratories for the instruction of students. This was done, for example, by Dr. Charles T. Jackson at Boston, in 1838; by Booth at Philadelphia, and by others elsewhere.

Between 1845 and 1850 a new period in American science began. Scientific schools were established at Harvard and Yale; the Smithsonian Institution commenced operations; the American Association for the Advancement of Science was organized. Laboratory instruction in chemistry at last acquired a foothold in our systems of education, and our oldest universities gave it a friendly though somewhat skeptical welcome. Year by year it grew into favor; it found its way beyond the scientific schools into the colleges themselves; the good results are visible to-day before the world.

One thing, however, was yet largely wanting, namely, the recognition, as an educational instrument, of original research. Individuals here and there were awake to its importance; but, in general, both chemistry and physics were taught from a utilitarian point of view; more as "bread and butter sciences" than as ennobling intellectual pursuits. Naturally, the lower work preceded the higher, but the latter came in due time. With stimulated interest and good preparatory training, American students in ever increasing numbers sought the advantages offered by the great universities of Germany. There, where science had attained its highest developments, they found research considered as the crown of a scientific education, as the best evidence of its completeness. Imbued with such ideas, having themselves shared in the labor of new investigations, they returned homewards to reënforce the small band of older teachers and workers. In all directions the modern university spirit was spreading.

In the year 1862 an event happened the full importance of which has

not yet been generally understood. It was during the darkest period of the civil war that Congress, notwithstanding the excitement due to current events, in spite of the pressure of affairs involving the very life of the nation, found time to pass an act granting to the several States large areas of public lands for the endowment of agricultural and mechanical colleges. After the war had ended, the seed thus generously planted began to grow. In some States the land grant went to strengthen old institutions, in others it founded new schools; but in every instance it was the modern scientific education that reaped the greatest benefit. It matters not that in some cases the national gift was recklessly mismanaged or foolishly squandered in expensive buildings; the general result was good. The Massachusetts Agricultural College sprang up within cannon shot of Amherst; Harvard found a rival in scientific teaching at the Institute of Technology, not four miles away; Cornell University arose to compete with the older colleges of New York; the Sheffield Scientific School was strengthened and improved. In nearly every State the new education secured a firmer foothold; modern methods of laboratory instruction were introduced; all the universities and colleges of America felt the influence and many followed the examples thus set before them. In short, the national land grant not only fulfilled the purpose for which it was originally intended, but it also gave to scientific education the greatest stimulus which the latter ever received upon this continent.

In 1864, Columbia College established its School of Mines, and a year later the Massachusetts Institute of Technology was organized. Shortly afterward, at the latter institution, Professor E. C. Pickering fitted up a physical laboratory, the first of its kind ever opened to students in this country, thus taking a lead which was rapidly followed by other schools and colleges. The new period in the teaching of physics was late in coming, but its development, now going on, is sure.

From 1865 down to the date of writing, the record is one of continuous and extraordinary progress. Within these few years the land grant colleges have come into existence, and by private benevolence many other institutions have been founded. In the latter class I need only mention, in the order of their foundation, the Stevens Institute, the University of Cincinnati, and the Johns Hopkins University. In all these schools science has full recognition and is taught by modern methods with modern appliances. During this period, also, Harvard has adopted its present elective system, the University of Pennsylvania has organized its scientific school, and the University of Virginia has stepped into new prominence as a centre of chemical research. To-day the higher chemistry can be studied in a score of places where twenty years ago no adequate facilities were offered, and the modern physics, with its mathematical methods and its laboratories, is rapidly coming into vogue.

One other feature of the new movement remains to be mentioned, namely, the spread of scientific teaching downward into the secondary

schools. These, too, are organizing laboratories, teaching young scholars to see and experiment for themselves, preparing the way for higher work, and rendering the latter more easily possible. The "summer schools" of chemistry at Harvard and elsewhere, the Woman's Laboratory at the Massachusetts Institute of Technology, and such like enterprises are doing much in this direction. To-day chemistry and physics are taught in nearly all the academies and high schools of the land; so that the larger colleges, whenever they see fit, may easily require from the candidate for admission a wider knowledge of these sciences than they themselves taught a dozen years ago. When and in what manner the present scientific movement shall culminate, no one can say; but the fact of growth is evident everywhere. This report is an attempt to catch the present aspect of affairs and fix it in a permanent record.[1]

CHAPTER III.

INSTITUTIONS FOR SECONDARY INSTRUCTION.

The reports received from over one hundred and seventy cities and from a very much larger number of private schools and academies show that instruction in chemistry and physics is very generally given. Only a few cities report *no* teaching in these branches; while many state that natural philosophy, at least, is orally taught in grades lower than the high schools.

Whether it is or is not desirable to teach the sciences in primary and intermediate schools is an open question. That the pupils become interested in such subjects and are able to profit by them there is no doubt. Oral instruction in chemistry and physics can certainly be made intelligible to children ten years old. But, on the other hand, there is at present a serious tendency towards overcramming the lower schools with a great variety of studies; and this tendency may lead to one of two results: it may either diminish the time allotted to the more important fundamental branches or it may injure the scholars by overwork. Neither result is desirable. Perhaps a compromise can be effected through the medium of the reading books, which might properly contain some short extracts relating to natural science. In some places The Child's Book of Nature is used as a text and is read aloud by the scholars. This plan is likely to be beneficial and is certainly not injurious.

In high schools and academies the teaching of chemistry and physics

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[1] In the preparation of this chapter free use has been made of Professor Benjamin Silliman's admirable monograph on "American contributions to chemistry." That paper, written as an address for the "Chemists' Centennial" at Northumberland, Pa., in 1874, has also been of great help in preparing some of the subsequent chapters.—F. W. C

varies between widely separated limits. In the great majority of cases mere text book work is done, only a few experiments being performed by the teacher. In some instances the scholars have laboratory practice in both subjects, the work in chemistry extending through a full school year and including the outlines of analysis. Between these extremes all conceivable variations are to be found.

That chemistry and physics are desirable branches to teach in schools of the grade now under discussion is pretty generally admitted, although a few educators still hold that such studies are fit only for technological institutes and colleges. But the greater number of pupils cannot go on into these higher grades, and must therefore either study the sciences now or do without them altogether. The latter alternative is clearly the wrong one to choose; at least, if we admit that education is anything other than a mere system of mental gymnastics. If subjects are to be learned quite independently of their relations to active life, then there is no ground for present argument; but if culture and utility are both to be considered we must recognize that some scientific training is indispensable. Nearly every pupil goes out of school into one of the great industries; and, whether he becomes a mechanic, manufacturer, railroad man, telegraph operator, farmer, miner, or tradesman, he is likely to encounter practical applications of the two sciences. In every avocation some knowledge of either physics or chemistry is almost certain to be directly useful; and this utility is often so great that the schools can better afford to err on the side of over-thorough teaching than in the opposite direction. How far, then, can these sciences be carried in such schools without detriment to other interests?

The answer to this question must vary with circumstances. One high school has three years and another four years in its total course of study; the latter is plainly able to give more time to any particular subject than the former. Every variation in the character of a school must involve corresponding variations in the treatment of these two sciences. It may be safe to put half an academic year as the minimum time assignable to either subject. A year can usually be given to each without difficulty.

Instruction should be general rather than special. The attempt is too often made to teach applied science when there are no foundations of science to apply. Such foundations should be thoroughly laid in the high schools and academies, so that the pupil who passes on to a university or polytechnic course may have a genuine preparation for advanced work. Fundamental ideas, like those of the conservation of energy, the correlation of forces, the conceptions of atoms and molecules, &c., ought to be clearly inculcated. The scholar should be made to realize that each science is a coherent whole with definite relations to other sciences, that all its parts are vitally connected, and that certain general principles are universally applicable in all of its branches. In chemistry it is better to concentrate all efforts upon the inorganic portion of the science, leaving the complicated organic side for more advanced

study. Along with the merely descriptive work should go a solid drill in chemical problems and chemical notation. Experiments made before classes ought to bear as far as possible upon main questions, and unavoidable details should be handled so as to illustrate clearly the great central ideas. When these have been fairly grasped, the scholar has gained something of both practical and intellectual value. His studies will have brought him not knowledge only, but also increased power.

The foregoing principles obviously relate to classroom work, and their successful application depends upon the teacher. He must have a vivid sense of what needs to be accomplished and enough special knowledge to render him in a measure independent of text books. These last may be useful or injurious, according to circumstances. If they have been chosen by an average school committee, influenced by some publisher more energetic than his rivals, they are likely to be worthless, and the teacher must be prepared to make good their omissions and correct their blunders. No text book can be taken as sole guide and followed without variation; but a good treatise upon either science, prepared, not by a professional school-book maker, but by a trained specialist, may be of great help to teacher and pupils. Text books written by amateurs, or by men who try to cover all the sciences, had best be rejected altogether. If a teacher cannot determine, from personal knowledge and experience, what manuals are best to use, let him seek the advice of the nearest specialist and follow it implicitly. In addition to classroom drill, laboratory practice should be an essential and prominent feature of every chemical or physical course. In the recitation or lecture, general principles are taught; in the laboratory, the student becomes familiar with methods and details. Three months of laboratory work will give more real insight into any science than a whole year's study of the printed page. To study chemistry from books alone is like learning a language from its grammar only, without attempting to translate or to write exercises. The pupil must learn to observe and to experiment for himself, in order to acquire any clear scientific knowledge.

That laboratory practice is feasible for young pupils, that it does not require any great degree of maturity to render it successful, all teachers familiar with that kind of instruction will readily testify. But, as there are some who still doubt the practicability of laboratory methods, a little evidence may well be here presented. The following letter, written by a teacher in New York to the Commissioner of Education, will serve as a specimen of the abundant testimony which has been accumulated:

DEAR SIR: Twenty years ago I was in the habit of having a teacher lecture on chemistry and physics in my school. I asked him what he would charge to sit still and not touch anything, but give directions and advice while a small class of boys handled what was necessary and made their own experiments. He said, "They will break things." I said, "Yes, you must take that into account." After thinking about it, he said, "I should have to charge five dollars an hour." This was rather dear, but I concluded to try it. The first trial convinced me that I was on the right track.

They were soon taught to handle acids, to bend glass tubes, as well as to make hydrogen and oxygen; and I saw small boys in my own school learn more of useful chemistry in three months than I learned in three years in college. Towards the close of the school year one of the boys came to me and asked for one of my visiting cards. On asking what for, I was told that their teacher of chemistry had informed them that there was a metal used in enamelling the cards, and they were directed to find it out. They did so.

Two years ago I had in my school my son of nine years. On asking my teacher of chemistry whether he thought so young a boy could learn chemistry in this way he said, "Certainly." Joining two others of that age with him, I was quite surprised at the end of two weeks to see them making their own hydrogen and oxygen and performing for themselves experiments that I used to look at with wonder when done by others while I was in college. I have pursued this practical system of teaching ever since, and always with success. My only difficulty has been to persuade parents to allow their children to be taught in this way. I have taken the liberty of writing to you at length about this matter because it seems to me very important, and perhaps some one else may be encouraged to pursue the same course. I have been amazed at the general apathy displayed about these studies, and am delighted at your trying to arouse the public to a proper sense of their importance.

The character and extent of laboratory work must, of course, be governed by circumstances. In general, as regards duration, it should coincide with the classroom instruction and divide time at least evenly with the latter. The kind of work to be done depends partly upon the facilities for doing. On this point certain misapprehensions are unfortunately common. The majority of school officials seem to suppose that laboratory work necessarily involves great expense, both for equipment and for running; in short, that without abundant means it is impossible. Some schools, reporting the value of their apparatus as high as two thousand dollars, complain that laboratory practice is too costly for them even to think of it; while others, with outfits not more than one-tenth as expensive, are actually doing good work in this direction. In one school we find an accumulation of showy but almost useless instruments, mere scientific toys; in another, every dollar is so expended that it counts for something of permanent solid value. If a teacher has the real scientific spirit, he can do a great deal with small appliances; but if his work is done in a perfunctory manner, then the best equipment in the world would serve him but scantily. The apparatus which a teacher contrives for himself with the aid of his scholars is oftentimes the most useful for purposes of instruction. Many and many a school has invested in trifling electrical playthings a sum of money which would have gone far towards the establishment of a simple working laboratory.

In physics the laboratory practice must needs be somewhat limited. The pupils may handle whatever apparatus happens to be available, learn its manipulation, and assist the teacher in the construction of simple appliances.[1] The magnetization of needles, the electrolysis of liquids, the verification of the fixed points upon a thermometer, and rough de-

[1] A special prize at the Paris Exposition of 1878 was awarded to a country school teacher who had made by his own labor and out of the commonest materials (glass bottles and the like) an apparatus for teaching the elements of physics and chemistry.

terminations of specific gravity, boiling point, and melting point are among the many experiments which ought always to be possible.

In the chemical laboratory a much greater variety of work is easily attainable. There are the ordinary experiments in manipulation, such as the bending of glass tubes, filtration, precipitation, distillation, &c.; the preparation of the commoner gases, acids, and salts; the verification of the more obvious properties of the chemical elements; and lastly, the simpler reactions of qualitative analysis. To the last named subject some time may always be profitably assigned. No other class of exercises will do so much towards impressing the average beginner or towards making him realize the nature of chemical reasoning. At every step it calls his powers of judgment into play. It involves the use of no costly apparatus, and enough can be done for all school purposes with a very moderate supply of the cheaper chemicals. At an expense of a hundred dollars a year a great deal can be accomplished; and an outlay of only one-fifth of that sum may yield results which are by no means to be reckoned as trivial. Again let it be said that success depends upon the teacher and not upon the cost of materials.

Work such as has been described above is actually being done in a very considerable number of schools. It can be done in all and with little extra effort. Twenty years ago the difficulty would have been to secure competent teachers. To-day this want is being met by the extension of scientific studies at the colleges, by improvements in the work of the normal schools, and by the establishment of summer courses of study and of laboratories like the Woman's Laboratory in Boston. Every year the number of teachers competent to give laboratory instruction is greatly increased, and before long the supply will be equal to any demand which is likely to arise.

To teachers who are at present engaged in elementary science teaching, and who have not been specially trained for such work, the following books upon experimentation will be highly useful: Frick's Physical Technics, Sadtler's Chemical Experimentation, Mayer's Sound, and Mayer and Barnard's Light. For private reading, outside of the range of ordinary text books, the following volumes are to be recommended: Cooke's New Chemistry; Hofmann's Modern Chemistry; Wurtz's History of Chemistry; Youmans's collection of essays upon the Correlation and Conservation of Forces, by Grove, Helmholtz, Mayer, Faraday, Liebig, and Carpenter; Tyndall's volumes on Heat as a Mode of Motion, on Sound, on Light, and on Electricity; Tait's Recent Advances in Physical Science, and Remsen's Theoretical Chemistry.

Numerous other works of value might be cited with these, but the list is already sufficiently long. All the books above mentioned are easily procurable, and no one of them is particularly expensive.

In the following pages only those schools are described from which laboratory work is reported. Additional details concerning them and

particulars relative to a large number of other secondary institutions are given in the statistical tables.

I.—TOWN AND CITY SCHOOLS.

In addition to the places especially described below, the following towns and cities report laboratory work as "permitted" in their respective high schools. Doubtless, in some cases, this merely indicates that students are allowed to assist the teachers in experimenting; in others it represents real laboratory practice of the modern kind: Augusta and Portland, Me.; Concord and Portsmouth, N. H.; Lawrence, Newton, and Somerville, Mass.; Providence, R. I.; Bridgeport, Hartford, and New Haven, Conn.; Auburn, Elmira, and Rochester, N. Y.; Orange and Trenton, N. J.; Erie, Harrisburg, New Castle, Norristown, Reading, Titusville, Wilkes-Barre, Williamsport, and York, Pa.; Lynchburg, Va.; Atlanta and Columbus, Ga.; Natchez, Miss.; New Orleans, La.; Akron, Chillicothe, Columbus, Mansfield, Portsmouth, and Zanesville, Ohio; Indianapolis, Ind.; Belleville, Decatur, Freeport, Jacksonville, Peoria, and Quincy, Ill.; East Saginaw, Mich.; Fond du Lac, Janesville, and La Crosse, Wis.; Council Bluffs and Dubuque, Iowa; and Portland, Oreg.

The following cities and towns report laboratory work more explicitly:

Lewiston, Me. High School.—Laboratory twenty-eight by thirty-five feet, with tables and sinks for thirty pupils. The course includes qualitative analysis.

Manchester, N. H. High School.—Classical scholars take chemistry for three months; English pupils, for forty weeks. Laboratory practice is required two hours weekly and includes analysis. The laboratory can accommodate fifty scholars.

Nashua, N. H. High School.—Each pupil has laboratory practice. The course includes analysis.

Boston, Mass. English High School.—The boys work through all the experiments in Eliot and Storer's Elementary Manual of Chemistry. The laboratory accommodates thirty pupils. Students in the post graduate or "advanced class" take up quantitative analysis.

No report was received from the Girls' High School. The writer is able to state, however, from his own personal knowledge, that laboratory work is done there.

Fitchburg, Mass. High School.—The laboratory facilities are sufficient for forty pupils. The course in chemistry includes qualitative analysis.

Haverhill, Mass. High School.—About thirty hours of laboratory work are required. It is elementary in character.

Lowell, Mass. High School.—There are laboratory exercises in analytical chemistry. The laboratory accommodates eighteen pupils; but plans are completed for the accommodation of eighty.

Salem, Mass. High School.—Laboratory work is required throughout

the chemical course. It is based upon Eliot and Storer's Manual. Some qualitative analysis is included.

Woburn, Mass. High School.—The chemical course occupies forty weeks. Laboratory practice is required three hours a week.

Worcester, Mass. High School.—The laboratory accommodates thirty students at once. In chemistry, text book and lectures occupy the first half of the year and laboratory work in qualitative analysis the latter half. In physics, the pupils are encouraged to use the apparatus.

Newport, R. I. Rogers High School.—General chemistry occupies six hours a week for a year; and of this time four hours a week are devoted to laboratory work. Analytical chemistry may be studied four hours a week for another year. The laboratory has places for twenty-four pupils.

Binghamton, N. Y.—Laboratory practice in chemistry is required four hours a week for six weeks.

Ithaca, N. Y. High School.—There is laboratory practice to a limited extent.

New York, N. Y.—See the "*College of the City of New York*," in the chapter on colleges.

Syracuse, N. Y. High School.—The pupils make tests and experiments in the class room.

Pittsburgh, Pa. High School.—Laboratory practice is compulsory in chemistry, optional in physics. It relates in chemistry chiefly to qualitative analysis and to the manufacture of chemical preparations.

Wilmington, Del. High School.—There is a special laboratory room twenty-two by thirty feet, with gas, water, sink, hood, &c. The students work in it to a limited extent.

Cincinnati, Ohio. Hughes High School.—The chemical laboratory accommodates eight or ten students at one time. *Woodward High School.* Laboratory tables are provided for twelve pupils working simultaneously. The laboratory course occupies in all about seventy-five hours. Compare also the account of the *University of Cincinnati*, given in the college chapter. The laboratory work of this institution begins where that of the high schools leaves off.

Cleveland, Ohio. High School.—Laboratory facilities for fifty pupils to work at once. Weekly practice in the laboratory is required and includes a little qualitative analysis. Extra work is encouraged, material for it being supplied gratis.

Newark, Ohio. High School.—Considerable laboratory work is required.

Sandusky, Ohio. High School.—Only simple experiments are required of pupils.

Fort Wayne, Ind. Central Grammar School.—All who study chemistry work in the laboratory one hour a day. A systematic course in qualitative analysis is given. The laboratory can accommodate twelve pupils at a time.

Lafayette, Ind.—Laboratory work in chemistry is required, and is based

upon Eliot and Storer's Manual. Thirteen students can work at once in the laboratory.

Logansport, Ind. High School.—In chemistry laboratory work is required, and includes the elements of qualitative analysis. In physics, the pupils have drill in adapting and handling apparatus.

Madison, Ind. High School.—Twenty weeks are devoted to each study. Six of these are given to practical work.

Richmond, Ind. High School.—The pupils are required to perform experiments in physics. In chemistry, laboratory work is compulsory for six weeks. It includes qualitative analysis for the thirty-six commoner bases and a dozen inorganic acids.

South Bend, Ind. High School.—Laboratory work in chemistry is required, and includes qualitative analysis.

Chicago, Ill. High Schools.—Five months' time is given to laboratory practice in chemistry. The laboratory accommodates eight pupils at once.

Grand Rapids, Mich. Central High School.—In chemistry there is laboratory practice twice a week for thirty weeks.

Madison, Wis.—Laboratory work is required.

Milwaukee, Wis.—The laboratory of the High School is large enough for twenty pupils to work in.

Burlington, Iowa.—In the laboratory twenty-four scholars can work at once.

Davenport, Iowa. High School.—Laboratory practice in chemistry is required.

Des Moines, Iowa. High School.—The laboratory contains tables and apparatus for twelve pupils. The laboratory work includes qualitative analysis, both wet and dry.

Omaha, Nebr. High School.—The teaching of chemistry is made, to a great extent, objective. All pupils are required to work in the laboratory, and all perform the simpler experiments. The more difficult experiments are performed by individual scholars before the class.

Kansas City, Mo. Central High School.—Chemistry is an optional study. Students who take it have practical work in manipulation.

Leavenworth, Kans. High School.—The pupils perform the experiments given in an elementary text book.

Denver, Colo. High School.—Each pupil performs the experiments given in Eliot and Storer's Manual.

San Francisco, Cal. Boys' High School.—In both studies the scholars are required, as far as possible, to show the text book experiments in the recitation room. In chemistry, each scholar is expected to repeat in the laboratory the experiments which he has seen.

II.—MISCELLANEOUS SECONDARY SCHOOLS, HIGH SCHOOLS, AND ACADEMIES.

Eaton Family and Day School, Norridgewock, Me.—During the course in chemistry experiments are performed by the scholars each day. There are public lectures and experiments by the pupils each week.

Phillips Exeter Academy, Exeter, N. H.—The students do a good part of the work of illustration in the physical laboratory.

Francestown Academy, Francestown, N. H.—Laboratory practice is required once a week.

Appleton Academy, New Ipswich, N. H.—The scholars perform the general experiments given in all elementary treatises on chemistry.

Goddard Seminary, Barre, Vt.—The students are required to perform common experiments.

Bristol Academy, Bristol, Vt.—The pupils spend as much time as possible in the laboratory. Qualitative analysis is reported as a part of the course.

Lyndon Literary Institution, Lyndon Centre, Vt.—The pupils work regularly in the laboratory, performing a large majority of the experiments given in elementary chemical text books.

Beeman Academy, New Haven, Vt.—Laboratory practice is required at least three times a week.

Caledonia County Grammar School, Peacham, Vt.—The pupils perform chemical experiments.

Glenwood Classical Seminary, West Brattleboro, Vt.—The scholars are required to perform experiments sufficient to adequately illustrate their lessons.

Phillips Academy, Andover, Mass.—One term, with Eliot and Storer's text book; laboratory practice is required twice a week. A second term, four times a week, is given to Douglas and Prescott's Qualitative Analysis. During a third term, twice a week, the same work is continued.

Punchard Free School, Andover, Mass.—In chemistry the students are required to perform the experiments given in Nichols's abridgment of Eliot and Storer's Manual. In physics, many experiments are shown with simple appliances, which the scholars are expected to repeat with apparatus of their own construction.

Chauncy Hall School, Boston, Mass.—There is a small but well equipped laboratory here, in which the students work in connection with the study of Eliot and Storer's text book.

Hitchcock Free High School, Brimfield, Mass.—The school has a laboratory in which much manipulation is done by the pupils.

Deerfield Academy and Dickinson High School, Deerfield, Mass.—Laboratory work includes three out of five recitation hours in chemistry, and about two out of five in physics, each week. The chemical and physical laboratories can accommodate about twenty pupils apiece.

Prospect Hill School, Greenfield, Mass.—The laboratory gives facilities for general chemical work, the blowpipe analysis of minerals, and elementary qualitative analysis. Practice in general chemistry is required, and the pupils also perform occasional experiments in physics. Analytical work is elective.

Sawin Academy, Sherborn, Mass.—Laboratory practice is required about three hours a week, except in organic chemistry. The laboratory

can only accommodate six pupils at a time, and is unprovided with gas; but it is ample for elementary purposes.

Academy of the Sacred Heart, Providence, R. I.—The scholars must write out on the blackboard each experiment described in the text book, explain symbols, &c., and then perform it satisfactorily.

English and Classical School, Providence, R. I.—Each pupil performs all the experiments in the laboratory for himself, through the course in elementary chemistry. Analytical chemistry is also provided for.

Friends' New England Boarding School, Providence, R. I.—Recitations in chemistry alternate or are combined with practical manipulation on the part of the pupil in the use of the blowpipe, simple reactions, making, collecting, and testing gases, &c.

Greenwich Academy, Greenwich, Conn.—All pupils must perform the more simple experiments. From the report, this rule appears to be applied in both chemistry and physics.

Mystic Valley Institute, Mystic Bridge, Conn.—Laboratory practice is required, but the extent of it is not definitely stated.

Connecticut Literary Institution, Suffield, Conn.—Three months are given to elementary chemistry, with simple experiments by the scholars. Four months are subsequently devoted to qualitative analysis, this subject being, however, elective.

Amsterdam Academy, Amsterdam, N. Y.—Chemistry and physics are wholly optional studies. About half the time in them is given to laboratory work.

Cayuga Lake Academy, Aurora, N. Y.—Chemistry and physics are optional studies. There is laboratory practice in qualitative analysis, the preparation of chemicals, &c.

Adelphi Academy, Brooklyn, N. Y.—The scientific students take six months of laboratory work, including analytical chemistry.

Clinton Grammar School, Clinton, N.Y.—The pupils try simple experiments.

Le Roy Academic Institute, Le Roy, N. Y.—The pupils do the work in Appleton's Young Chemist.

Franklin Academy, Malone, N. Y.—Laboratory work is provided for, but it is optional.

Fort Washington College, New York City.—Laboratory practice is required at least one hour a week.

John MacMullen's School, New York City.—Chemistry and physics are extra studies, and are taught entirely by laboratory work.

Rockland College, Nyack, N. Y.—Laboratory practice is required up to analysis.

West Winfield Academy, West Winfield, N. Y.—Laboratory practice is required three hours a day. The course is wholly optional, and includes analytical chemistry. At the date of reporting there were five pupils in the latter subject.

South Jersey Institute, Bridgeton, N. J.—Laboratory work is optional, but most of the pupils devote one hour a day to it.

Centenary Collegiate Institute, Hackettstown, N. J.—Laboratory practice averages three hours a week for a year during the scientific course. The work includes elementary manipulation and qualitative analysis. In the classical course but half a year is given to chemistry.

Maplewood Institute, Concordville, Pa.—The pupils learn to analyze common minerals.

Hollidaysburg Seminary, Hollidaysburg, Pa.—The course in chemistry includes elementary experiments by pupils and not less than five months of laboratory practice in analysis. The laboratory comprises a basement room seventeen by thirty-nine feet and an upstairs room twenty feet square. The latter is used also for recitations.

Friends' Select School, Philadelphia, Pa.—Chemistry is taught for a year, and laboratory work, based on Eliot and Storer's text book, occupies two hours a week. There is also laboratory instruction in physics.

Miss Anable's School for Young Ladies, Philadelphia, Pa.—All the pupils engage in laboratory work.

Westtown Boarding School (Street Road Station), Pa.—In the boys' department there is a working laboratory for twelve or fifteen pupils, fitted both for manipulation and for qualitative analysis. The girls have a smaller laboratory for ordinary experimentation only. Laboratory practice is optional, but is nearly always taken.

Friends' Elementary and High School, Baltimore, Md.—In chemistry there is nearly a four years' course, with exercises every alternate day, beginning with elementary work and ending with qualitative analysis.

Charlotte Hall School, Charlotte Hall, Md.—Laboratory practice is required in the line of chemical testing.

College of St. James Grammar School, Washington County, Md.—The pupils learn to perform simple experiments and to apply tests for the recognition of common substances.

Lutherville Female Seminary, Lutherville, Md.—The pupils all do some laboratory work.

Kenmore University High School, Amherst C. H., Va.—Laboratory practice occupies three hours a week during four months. The laboratory is supplied with apparatus for both qualitative and quantitative analysis.

Bethel Military Academy, Bethel Academy, Va.—Laboratory work is required only so far as is necessary to test poisons and to generate gases.

Academy of Richmond County, Augusta, Ga.—From three to six hours a week during nine or ten weeks is given to laboratory work, including qualitative analysis.

Shorter College, Rome, Ga.—Laboratory work is required enough to familiarize the students with the apparatus.

Talladega College, Talladega, Ala.—The scholars perform the common experiments.

Macedonia Academy, near McKenzie, Tenn.—The pupils work in the laboratory until they can illustrate practically what they have learned from text books.

Peabody High School, Trenton, Tenn.—The students have limited practice in a small laboratory.

Minerva Male and Female College, Minerva, Ky.—The study of chemistry occupies three terms. There are two laboratory exercises a week with the teacher and two by the students alone.

Chickering Institute, Cincinnati, Ohio.—Laboratory facilities are offered and nearly all the scholars avail themselves of them.

Brooks Academy, Cleveland, Ohio.—Both qualitative and quantitative analysis are taught, with two years of laboratory practice. The laboratory has tables for thirty-two students working simultaneously.

Springfield Seminary, Springfield, Ohio.—The pupils try most of the experiments themselves.

Spiceland Academy, Spiceland, Ind.—Chemistry is taught six months, three of which are given to work in the laboratory. Some of this time seems to be devoted to analytical chemistry.

Northern Illinois College, Fulton, Ill.—The students have experimentation in the laboratory.

St. Mary's Academy, Monroe, Mich.—The pupils perform the experiments in Steele's and Hooker's text books.

Lake Geneva Seminary, Geneva, Wis.—At least one hour a day is spent in the laboratory, with Douglas and Prescott's Qualitative Analysis.

Madison High School, Madison, Wis.—Each pupil does a little laboratory work.

Blairstown Academy, Blairstown, Iowa.—The scholars perform the simpler experiments.

St. Agatha's Seminary, Iowa City, Iowa.—The scholars work in the laboratory daily, in turn.

Napa Collegiate Institute, Napa, Cal.—The pupils repeat the experiments given by the instructor and perform others as directed. Some work from four to five hours a week. Analytical chemistry is taught.

California Military Academy, Oakland, Cal.—Laboratory work occupies about two hours a week.

Umpqua Academy, Wilbur, Oreg.—The laboratory is small and imperfect, but students are compelled to make use of it.

CHAPTER IV.

NORMAL SCHOOLS.

In the normal schools, the time which can be assigned to work in chemistry and physics is necessarily very limited. It is not the purpose of such schools to train specialists in any one department of learning, neither do they attempt to give a broad general education. Their sole function is to fit students for the profession of teaching, and so far as they exceed this function they leave the class under which they belong and approximate themselves to the ordinary high schools and academies.

An examination of the evidence presented in this report will show a great diversity among the various normal schools with respect to chemistry and physics. By far the larger number of them treat these sciences exactly as they are treated in secondary institutions and the smaller colleges; that is, they teach the elements of both subjects, partly by text books and partly by lectures; a few experiments are exhibited, and laboratory work on the part of the students is entirely ignored. In other words, the practice of these schools with reference to the sciences does not accord with the theory upon which they were originally founded.

A smaller number of normal schools adopt a more rational policy. Recognizing the fact that their students may be called upon to teach chemistry and physics, they endeavor to train them intelligently in methods of instruction. Laboratory practice in both sciences is exacted, on the ground that every teacher should know how to handle chemicals and apparatus and be able to perform simple experiments before his pupils. The full realization of this principle naturally suggests another. The ordinary teacher has as a rule little apparatus to use; he must either do without experiments or else improvise instruments for himself; he has to cultivate the art of getting along with makeshifts. This fact clearly indicates an important line of work for the normal school laboratory. The student should there be taught to construct simple apparatus out of the commonest materials; to make, for example, a pneumatic trough out of a wash-basin; an electrophorus from a tin plate and some sealing wax; a galvanic battery with a few bits of wire, scraps of copper and zinc, and half a dozen tumblers. Such a training as this will be invaluable to the future teacher. It vastly increases his power to interest and instruct his pupils, and at the same time it deepens his own insight into the subjects taught. This discipline, carefully applied, it is clearly proper for the normal schools to give. The policy thus briefly indicated is one of recent growth, but it is gaining ground rapidly.

The following pages contain an outline of the laboratory work reported from various normal schools. Details concerning the general courses of study in chemistry and physics, the text books employed,

&c., are given in the statistical tables. Such schools as report no laboratory work for students are described only in the last named portion of this document.

Eastern State Normal School, Castine, Me.—About one-fifth of the time allotted to chemistry is spent in laboratory work. Text book, Eliot and Storer.

State Normal School, Framingham, Mass.—Laboratory practice accompanies the study of chemistry. Elementary work only is done. No text book is used, the instruction being oral. The laboratory was equipped only a few years ago.

State Normal School, Salem, Mass.—Laboratory practice is required of the students, but neither its amount nor its character is definitely stated.

Massachusetts State Normal School, Worcester.—Laboratory work occupies half an hour a day. All students devote four weeks to it in general chemistry and six weeks in qualitative analysis. The laboratory has accommodations for eighteen pupils.

Rhode Island State Normal School, Providence.—A laboratory has been recently equipped, and practice in it is required. Text book, Eliot and Storer.

State Normal School, Cortland, N. Y.—The laboratory accommodates eighteen pupils at a time. Practice is not required except at the hour of recitation; but many students work in the laboratory from one to two hours a day extra. Text books, Eliot and Storer and Fresenius's Qualitative Analysis. The work is so accomplished that the pupils are qualified to take charge of high school laboratories, &c., and to introduce laboratory methods into their schools.

State Normal and Training School, Oswego, N. Y.—At the date of reporting, the work in chemistry and physics in this school was in somewhat of a transition state. A small chemical laboratory was in operation, but the building was undergoing enlargement, so that permanent laboratory facilities could be offered on a larger scale. It is Professor Straight's purpose to introduce into the school laboratory methods of instruction, not only in chemistry, but also in physics, in order to teach the use and construction of simple apparatus. In aid of this work, such text books as Tyndall's Electricity, Mayer's Light, &c., will be used.

West Chester State Normal School, West Chester, Pa.—Laboratory practice in qualitative analysis is required in the scientific course, two hours a day, four days each week. The laboratory contains four work tables. In the elementary course, chemistry is not required.

Pennsylvania State Normal School, Bloomsburg.—In chemistry, Eliot and Storer's text book is used by pupils of the scientific course. The class are expected to perform at least the experiments described in the book.

Maryland State Normal School, Baltimore.—All students are required to perform, simultaneously, the simpler laboratory operations. No text book is used, but special tables in chemical analysis are printed for the

scholars. The students are taught and encouraged to use apparatus of the simplest possible construction. They make their own blowpipes, bent tubes, wash bottles, spirit lamps, pipettes, &c. The object is not to make them chemists, but to enable them to teach the elements of chemistry, in an interesting and practical manner, in common schools, where the ordinary apparatus is unattainable.

Glasgow Normal School, Glasgow, Ky.—Laboratory practice is required one hour a day during the entire chemical course. A good deal of extra laboratory work is also done. Students are taught to make apparatus from the simplest materials at hand, in order to fit them for teaching. This plan of instruction has been in operation for about five years, and meets with continually increasing favor.

Kentucky Normal School, Carlisle, Ky.—Physics is a part of the required work, and students are expected to improvise simple apparatus and to perform their own experiments. Chemistry is not reported.

Cincinnati Normal School, Cincinnati, Ohio.—Physics is taught to a limited extent, but not chemistry. For both sciences the school relies largely upon the Cincinnati high schools and the University of Cincinnati. As far as possible, the students are required to perform experiments and to illustrate by drawings on the board. Explanations must be simple, concise, and in language plain enough for young children to comprehend.

National Normal School, Lebanon, Ohio.—In chemistry there is a course of ten weeks, with daily recitations, and one hour daily of laboratory practice. In physics, the course extends over the same length of time, and includes daily practice with apparatus.

Ohio Central Normal School, Worthington, Ohio.—About one-eighth of the time allotted to the sciences in question is given to laboratory work. The instruction is practical and of such a nature that it may be repeated in the schools of which the students eventually take charge.

Southern Illinois Normal University, Carbondale, Ill.—All who graduate or enter upon a course of chemistry must do laboratory work. The laboratory is well equipped for elementary manipulation and for qualitative analysis. Experiments are performed before the class, and each member is expected to repeat as many as possible. Much extra work of this kind is done. A short course in mineralogy, with blowpiping, follows the analytical work.

Cook County Normal and Training School, Normalville, Ill.—Laboratory work is required during the entire course in chemistry, which occupies two terms. Eight weeks are given to qualitative analysis. An attempt is made to teach how simple apparatus may be constructed and used.

Michigan State Normal School, Ypsilanti.—Laboratory practice is required of all who graduate. Much attention is given to chemical manipulation, to ready and cheap methods of illustrating chemical properties and affinities, and to the performance of the experiments described

in the ordinary text books. In physics a large amount of experimentation is accomplished.

State Normal School, Oshkosh, Wis.—In chemistry seventeen weeks are devoted to general work, with daily experiments by the students. This course is followed by six weeks in qualitative analysis. The laboratory contains five tables or stands. In physics the students assist at experimentation, and also do work in the construction of apparatus.

State Normal School, Winona, Minn.—Laboratory practice is required of all students one hour a day for thirty weeks. Text book, Eliot and Storer, which is studied for a year. In physics the experiments are performed both by the teacher and the pupils.

State Normal School, Mankato, Minn.—The text book used in chemistry is Appleton's Young Chemist, and students are required to perform the experiments described in it.

Eastern Iowa Normal School, Grandview, Iowa.—Laboratory practice is required so far as is necessary to give the students a practical knowledge of the most common chemical processes.

State Normal School, Emporia, Kans.—Laboratory practice is expected of all the class.

California State Normal School, San José, Cal.—Ten weeks of laboratory practice are required; text book, Youmans.

CHAPTER V.

INSTITUTIONS FOR THE SUPERIOR INSTRUCTION OF WOMEN.

Under this heading will be found the various female seminaries and academies, together with the larger number of the so-called female colleges. A few of the latter institutions—such as Vassar, Wellesley, Smith, and Wells Colleges—will be found described in a subsequent chapter, since in organization and methods they more definitely resemble the higher grade of colleges proper.

The schools now under consideration vary widely from each other. Some are almost secondary in the character of their work; others are partly collegiate. In a large number of them regular normal training is provided for. No one set of rules as to the teaching of any subject can apply to more than a respectable majority of these institutions. The principles which should govern them in their teaching of chemistry and physics must vary with their character and their aims.

One of the questions sent out on the circular issued by the Bureau of Education, preparatory to this report, ran as follows: "Are pupils permitted to do extra laboratory work?" To this the president of one of the female colleges answers: "Being girls, no." This answer typifies a widespread sentiment and a common misapprehension as to the object of scientific teaching. It may represent the assumption that girls are

in some mysterious way unfit to undertake laboratory practice or the belief that such instruction would be useless to them. Neither view is correct, as the experience of many teachers of science can testify.

Enough has already been said in preceding chapters upon the importance of laboratory instruction as a means of impressing upon pupils definite scientific ideas. No further argument upon that point is necessary here. A few words may, however, be said concerning the value of chemical knowledge to women, considering the latter not as school teachers, but as the heads of households.

A glance at such a work as, for example, Johnston's Chemistry of Common Life will immediately convince any person, otherwise unfamiliar with the subject, of the wonderful applicability of science to every day affairs. Not only does it affect the larger and more conspicuous industries; it is also involved in many of the petty details of housekeeping. In the laundry, the relative merits of different soaps and the peculiar properties of hard and soft waters come into question; what will whiten cloth without rotting the fibre; how can stains be removed from linen; which colors are fast and which are fleeting, are types of the problems that continually arise. The use of antiseptics and disinfectants after or during sickness; the detection of lead in the drinking water; the recognition of impurities in milk, sugar, flour, vinegar, pickles, tea, or coffee, are subjects which often become of serious importance. It is not necessary to multiply these examples. They are sufficient to illustrate my meaning and to show the utility of chemistry to women. True, it is not possible to make chemists of all girls, and yet the latter may be so trained as to consider intelligently the scientific questions involved in household affairs. The usage of the schools admits that chemistry is one of the things to teach them; and the writer merely urges that the instruction shall be given in such a manner as to render the science one of living interest. Good teaching in chemistry will surely be as useful in the long run as a training in those accomplishments and ornamental studies which are so often utterly neglected in after life. That women are peculiarly successful as laboratory students, dozens of teachers can certify. The schools need only to encourage laboratory work in order to insure that it will be eagerly done.

The following sixteen institutions of this class offer regular laboratory instruction. Eighty-nine reported.

Maine Wesleyan Seminary and Female College, Kent's Hill, Me.—In chemistry there are two terms' work of thirteen weeks each, with laboratory practice. Qualitative analysis is optional. Text book, Nichols's Eliot and Storer. The same amount of time is given to physics, with experimental work, optional for teachers. The chemical laboratory can accommodate about ten students at a time.

Bradford Academy, Bradford, Mass.—Here, under Miss Sarah M. Dawson, very thorough elementary work is done in both chemistry and physics. Laboratory practice is required in chemistry, four hours a

week, for thirteen weeks, on the basis of Eliot and Storer's Manual. The laboratory accommodates twelve students and is well equipped for general chemistry only. The term in chemistry is followed by a term in the chemical analysis of minerals, according to Brush's text book. The same number of hours are given to this work as are allotted to general chemistry; about thirty analyses are made and one hundred minerals are identified.

Wheaton Seminary, Norton, Mass.—Chemistry and physics are well handled in this institution by Miss Clara M. Pike. In chemistry, there is a four months' prescribed course, involving an average laboratory practice of two hours a day. Qualitative and quantitative analyses are optional; but the class in general chemistry at the time the report was written, twelve in number, have decided to take up qualitative analysis, working one hour a day.

Mount Holyoke Female Seminary, South Hadley, Mass.—There is here a newly furnished chemical laboratory. Although laboratory work is optional, it is generally taken. In physics, Atkinson's Ganot is studied; there is a course of lectures, and some experiments are performed by pupils.

Packer Collegiate Institute, Brooklyn, N. Y.—Optional laboratory practice is provided for in this institution, on the basis of Jones's Practical Chemistry.

Academy of Mt. St. Vincent-on-the-Hudson, New York City.—The pupils perform all the experiments given in Steele's Fourteen Weeks in Chemistry.

Wilson College, Chambersburg, Pa.—The students repeat in the classroom all the experiments given by the teacher in her lectures. This is in the junior year and occupies one semester. Text book, Roscoe. In the senior year a second semester in qualitative analysis and applied chemistry, with laboratory practice, is offered.

Marietta Female College, Marietta, Ga.—The students do laboratory work to the extent prescribed by Youmans's text book. The laboratory is but just begun.

Judson Female Institute, Marion, Ala.—The pupils perform simple experiments.

Silliman Female Collegiate Institute, Clinton, La.—Laboratory work is required of all students.

W. E. Ward's Seminary for Young Ladies, Nashville, Tenn.—Almost daily some student lectures and performs the experiments which the teacher performed the day before.

Daughters College, Harrodsburg, Ky.—In chemistry there is an elementary text book course, followed by daily laboratory practice. After this, a course in qualitative analysis is provided. All normal students are required to work in the laboratory from one to three hours daily.

Bartholomew English and Classical School, Cincinnati, Ohio.—The laboratory facilities are such as to enable the students to perform the

experiments described in Nichols's abridgment of Eliot and Storer's Manual.

Cincinnati Wesleyan College, Cincinnati, Ohio.—The laboratory, twenty-five by forty feet in area, is well equipped and contains tables for forty students. In chemistry there is an average of one hour laboratory practice daily, including spectroscopic and blowpipe work and qualitative analysis.

Rockford Female Seminary, Rockford, Ill.—Chemical laboratory work is required three hours a day for ten weeks. Some of the work at least, if not all, is in qualitative analysis.

Milwaukee College, Milwaukee, Wis.—Qualitative analysis is a required study during twenty weeks; text book, Eliot and Storer. The laboratory is a well fitted room twenty-five feet square.

CHAPTER VI.

UNIVERSITIES, COLLEGES, AND SCHOOLS OF SCIENCE.

The institutions described in this chapter are so varied in character that they might with propriety have been divided under several different headings. But the work of many scientific schools so interacts with that of the universities to which they are attached, and the colleges organized for special purposes so often give general courses of instruction, that it becomes difficult to select useful dividing lines. For reasons such as these the present grouping was adopted.

In preparing the text of the chapter, a single rule was followed. With few exceptions, only those institutions are described in which laboratory work is done by students and carried as far as a course in qualitative analysis. The other colleges are duly treated of in the statistical tables. The only cases here included which do not fall under the rule are two or three of the older colleges, which, although backward in their scientific work, are so well known generally that information would be likely to be looked for concerning them.

The details now given have been drawn from a variety of sources. The official answers to the questions sent out by the Commissioner of Education, the catalogues of the several institutions, and many personal communications made directly to the writer were carefully compared. In some cases the catalogues gave all the particulars which could be obtained; in others, very full manuscript material was submitted. In fact, some of the latter could be used almost exactly as it was received, only a few verbal changes being needed in the way of editing. Frequently, discrepancies were encountered between duplicate returns from a single school or college, and it is therefore possible that errors may be detected which are really due to this cause.

In certain particulars the information given was almost uniformly

meagre. The question relative to original researches, for example, was often ignored or misapprehended. Certain important colleges sent in no list of investigations, while others reported full catalogues, sometimes too full for publication. Some of these catalogues included not only the titles of researches proper, but also references to medico-legal investigations, to published expert testimony in patent cases, and to the printed analyses of commercial products. Of such material no satisfactory use could be made, and in this direction the report is necessarily imperfect.

The character of the work done in chemistry and physics naturally varies with the character of the several institutions. In the larger number of colleges, those, namely, which are described only in the statistical tables, the studies in question occupy much the same position which they do in the ordinary high schools and academies. In fact, they repeat the work of the latter, giving almost exactly the same courses of elementary recitations in chemistry and physics, from the same text books and with the same class experiments. A reference to the foregoing chapters will show at once that many high schools are actually doing more and better work with these sciences than is done in a very considerable number of colleges bearing good reputations. Clearly these colleges could, if they would, build upon the work of the preparatory schools as a foundation, and, with no more cost of time, carry their pupils much further than they do now. The present subordinate position of scientific studies is undoubtedly due to the continuation in so many localities of the old-fashioned plan of a fixed curriculum. Given a college in which the latter still holds its own and in which the classics and mathematics have been for many years the dominant subjects of study, and we have an institution wherein but little time can be given to any one of the sciences. One term, from a third to half an academic year in length, is all that is usually allowed to chemistry. This is as absurdly inadequate as one term in Latin or one term in mathematics, with no previous preparation, would be. By this system the sciences are not only underrated, but smattering is directly encouraged. The student trained in it can have no definite idea of scientific methods, scientific reasoning, or the scientific spirit. Even the professor in charge of the sciences may be himself a smatterer, teaching several branches without ever having received a systematic training in any one of them. Such teachers, who keep ahead of their classes by only a few lessons, are unfortunately very common, and with them the modern laboratory methods are simply impossible.

It will be seen that, with a few honorable exceptions, the colleges which are doing the best work in chemistry and physics are those which have adopted the elective system. In these colleges the student who becomes interested in a science during the earlier portions of his course is not obliged to drop it for some less attractive subject, but may carry it on from year to year, until he is qualified for original investigation.

The scientific schools differ from each other almost as widely as do the colleges. One, for example, is exclusively a school of engineering, in which chemistry and physics are purely incidental studies. Others devote especial attention to giving mechanical training, to mining, or to chemical technology. In nearly all of them applied science, so called, is mainly cultivated, with inorganic and analytical chemistry and general physics as prominent objects of study. In only a few of these schools does pure science receive adequate attention; the intellectual side of education is sacrificed to the material. Modern organic chemistry, the higher mathematical physics, and pure research are among the subjects which are too commonly ignored. It would be easy to point out institutions in which science is governed by a wholly commercial spirit and whose professors are so absorbed in expert work outside that they have neither time nor inclination to encourage scholarship within. This state of affairs is, of course, only transitory, but it is unfortunate that it ever should have been permitted to come into existence. Of course, applied science must be taught, and taught thoroughly; but every student should be made to realize that all of its achievements are outgrowths of original researches, and that it is only through the latter that future growth can be maintained. No one should be permitted to graduate as a chemist without some discipline in research work, since the same methods which are involved in settling a purely scientific question also apply to the solution of important industrial problems.

As for the agricultural colleges, little need here be said. As far as they confine themselves to training agriculturists, their work in chemistry and physics is necessarily very special. With only a few of them scientific experimental stations are connected; but this feature seems likely to be the one of greatest future development. It is certainly one of great present utility.

Before going on to the description of individual institutions, a few words are desirable as to the treatment given to physics in this portion of the report. The returns sent in concerning this science exhibited curious variations, caused by diversity of opinion as to what should be included in it. Quite a number of colleges, for instance, reported astronomy as a part of physics, while others excluded everything beyond the ordinary experimental outlines. In some cases mechanics was described as a part of the physical course; in other institutions this subject seems to have been considered as purely mathematical, and was not mentioned at all. This lack of uniformity necessarily affects the character of the report. Astronomy is not included, being regarded by the writer as a separate science. Mechanics is, however, brought in, together with other branches of mathematical physics, to as great an extent as the rather incomplete material would allow.

MAINE.

BOWDOIN COLLEGE, AT BRUNSWICK.

Physics.—In the classical department this subject is taught by lectures and recitations during the first third of the junior year. In the scientific department it is studied for two junior terms, the second one including work in spectroscopy and photography. Students in civil engineering have some work in the physical laboratory, and in the third term of the junior year they study the barometrical measurement of heights.

Chemistry.—Henry Carmichael, professor of chemistry and mineralogy. Studied by the classical students during the second junior and the second and third senior terms. The work includes lectures, recitations, and laboratory practice; the last is in analytical chemistry. In the scientific department chemistry runs through the sophomore year and includes laboratory practice. It is also put down for the second and third senior terms, apparently as an elective, although this is not definitely stated. The engineering students, in their first senior term, take up also the chemistry and metallurgy of iron and steel. A fee of five dollars a term is charged for the use of the analytical laboratory. In the year 1878 a summer school of science was opened in connection with the college, and analytical chemistry was among the subjects taught. This school was not continued in 1879.

COLBY UNIVERSITY, AT WATERVILLE.

Physics.—The professor of physics teaches also astronomy. One term is devoted to mechanics, hydrostatics, and pneumatics, one-half a term to sound and magnetism, and one term to light and electricity. Text book, Snell's Olmsted. This study is wholly prescribed.

Chemistry.—The professor of chemistry teaches also mineralogy, geology, and physiology. Instruction is given by lectures, notes and accompanying recitations being required. Laboratory work is based upon lectures also. One-half term is given to chemical physics, one term to general chemistry, one to elementary chemical manipulations, and one to qualitative analysis. One term of chemistry is required; the rest is optional. A laboratory room is provided, and the facilities are being increased year by year. Resident students are allowed to use the apparatus during vacations; and graduate students who are teachers are encouraged in the same way. No research work is reported.

The president of Colby University reports a constantly increasing demand for instruction in chemistry, which is being met as rapidly as circumstances will allow. Physics has been taught from the first; but the time devoted to it and the ground covered have been nearly doubled within the past twenty years.

MAINE STATE COLLEGE OF AGRICULTURE AND THE MECHANIC ARTS, AT ORONO.

In this college there are five regular courses of study, as follows: (1) in agriculture, (2) in civil engineering, (3) in mechanical engineering, (4) in chemistry, and (5) in science and literature. Special students are also received.

Physics.—Taught by the president of the college, M. C. Fernald, who also teaches mental and moral science. Required of all regular students during the first half of the junior year. The work consists of daily exercises, which are sometimes recitations and sometimes experimental lectures; the students take notes and solve problems, and there is an examination at the end of the term. Text book, Atkinson's Ganot. No laboratory work and no original researches are reported.

Chemistry.—Professor, Alfred B. Aubert. Required of all regular students through the sophomore year. The students in agriculture continue the study during the junior year and the candidates for a chemical degree carry it on to the end of the course. In the first sophomore term there are daily recitations in general chemistry, based upon Roscoe's text book. These are supplemented by lectures. During the first junior term, the students in courses 1 and 4 recite daily together in agricultural chemistry. Through the second junior term and the whole senior year, the chemical students have daily recitations from Naquet's Principes de chimie, the latest French edition.

In courses 1 and 4 at least two hours daily through not less than nineteen weeks of the sophomore year are spent upon qualitative analysis in the laboratory. Quantitative analysis, at least two and a half hours daily, runs through the junior and senior years in course 4, but only through the junior year in course 1. The work done in quantitative analysis covers the usual ground of gravimetric and volumetric determinations, including assaying for gold and silver. Special attention is necessarily paid to agricultural analysis. Organic combustions and the more difficult analyses of complicated minerals, cast iron, and so on are undertaken by post graduate students. No original researches in chemistry have yet been published from this college.

The laboratory facilities are good. The laboratory building contains two apparatus rooms, a lecture room, a cabinet, a library and weighing room, a recitation room, and rooms for analytical purposes. The general laboratory room measures 35 by 60 feet, is provided with gas and water, and accommodates thirty-two students. There is about the usual supply of apparatus and chemicals.

BATES COLLEGE, AT LEWISTON.

No report was received from this college. Such information as could be gleaned from its catalogue will be found in the statistical tables.

NEW HAMPSHIRE.

DARTMOUTH COLLEGE, AT HANOVER.

Physics.— C. F. Emerson, professor of natural philosophy and instructor in astronomy. The chair is specially endowed with about $45,000.

The course begins with analytical mechanics in the last half of the sophomore year. There are sixty-five recitations from Wood's text book, and a few illustrative lectures. At the opening of the junior year, physics proper begins, and continues twenty-seven weeks, with five recitations and one or two lectures each week. In all, there are one hundred and thirty-five recitations and about forty lectures. Atkinson's Ganot is used and studied throughout with the omission of only a few pages.

During the first term of the senior year there is an optional course in practical physics of sixty exercises, or four afternoons a week for fifteen weeks. This is based upon Pickering's Physical Manipulations. The course is just opening, and the physical laboratory is only begun. The collection of apparatus is quite extensive, especially in acoustics, light, and electricity.

The first professor of physics at this college was appointed in 1782. Instruction in early times seems to have been given chiefly by lectures, the use of text books increasing as books improved. During the incumbency of Professor C. A. Young, important researches in solar physics were carried out and published.

Chemistry.—E. J. Bartlett, associate professor of chemistry. B. T. Blanpied, professor of chemistry in the Agricultural College. The regular course occupies four hours a week during eleven weeks, the last term of the junior year. Miller's text book is used, accompanied by lectures and experiments before the class. In the middle term of the senior year there is an optional course of four hours a week in laboratory practice.

The Agricultural College has a general course of study extending through only three years. In the middle year, Barker's Chemistry is studied for two terms and Douglas and Prescott's Qualitative Analysis for the third term. In the first term of the senior year, quantitative analysis is optional.

The first professor of chemistry was appointed in 1820; but, as with physics, the instruction was chiefly given by lectures. The Agricultural College was connected with Dartmouth by an act of the legislature passed in 1866.

VERMONT.

UNIVERSITY OF VERMONT AND STATE AGRICULTURAL COLLEGE, AT BURLINGTON.

Both chemistry and physics are taught by Prof. George A. Smyth.

Physics.—Required for about twelve weeks at the beginning of the junior year. The course is based upon Balfour Stewart's text book, which gives as much work as there is time for. The sophomore scien-

tific students recite with the classical juniors. The apparatus is not nearly complete.

Chemistry.—The classical students take chemistry in the first third of the sophomore year. The instruction is given by experimental lectures. A little laboratory work sometimes is taken as an extra. Students in the literary-scientific course may take chemistry in place of Greek. Engineering students receive two terms' instruction, lectures in the first freshman term and laboratory work in the second.

The agricultural and chemical students have chemistry throughout the course, except in the third term freshman and junior years. Even in these terms, however, a little chemical work may be done. The course of study is about as follows: Freshman year: First term, lectures on descriptive chemistry; second term, theoretical chemistry and laboratory work, the former being taught by recitations from Barker's text book and the latter consisting of exercises in manipulation and the preparation of chemical products. Sophomore year: First and second terms, qualitative analysis (Fresenius); third term, quantitative analysis. Junior year, first and second terms, quantitative analysis continued, both gravimetric and volumetric. In the second term, assaying and metallurgy are optional. Senior year: First term, recitations in organic chemistry and laboratory work. In the second and third terms, the agricultural students study agricultural chemistry. The chemical students do organic laboratory work in the second term, and during the third they take analytical, organic, or technical chemistry, according to option.

The laboratory is good as far as analytical chemistry and assaying are concerned, but is not equipped for advanced research. Special students, not members of regular college classes, may be admitted to work in it. Chemistry has been taught in the university, by lectures and recitations, since about 1830.

MIDDLEBURY COLLEGE, AT MIDDLEBURY, AND NORWICH UNIVERSITY, AT NORTHFIELD.

These institutions furnish only the old-fashioned prescribed courses of chemistry and physics incidental to a regular college curriculum. No laboratory work is reported from either. All necessary details are given in the tables at the end of this report.

MASSACHUSETTS.

From Boston College, and from the College of the Holy Cross, at Worcester, no reports were directly received. Probably neither institution undertakes more than elementary work in either physics or chemistry.

AMHERST COLLEGE, AT AMHERST.

Physics.—Elihu Root,[1] professor of mathematics and natural philosophy. The required physics consists of a course of experimental lectures,

[1] Died in the latter part of the year 1880.

four hours a week, during the whole of the junior year. These lectures are supplemented by notes, multiplied with the aid of the electric pen, containing references to Deschanel's and Ganot's text books.

The optional physics is open only to students who have completed the full course in the calculus. Text books are as follows: Fall term, Sturm's Cours de mécanique and Kirchhoff's Mathematische Physik; winter term, Donkin's Acoustics and Helmholtz's Tonempfindungen; summer term, Verdet's Optique. Throughout the year practical work is done in the physical laboratory. The outfit of apparatus is good for the lecture room; not so good for laboratory purposes.

A prize of $30 is annually given for scholarship in natural philosophy.

Chemistry.—Professor E. P. Harris and Instructor Leverett Mears. This science is a required study only for one term of the sophomore year. The full course given, however, includes elective work and covers two years. Instruction is given as follows: First, a course in general chemistry, relating to the non-metallic elements; second, a course on the metals; third, a thorough course in qualitative analysis, of two terms' laboratory work; fourth, a course in chemical physics; fifth, a course in organic chemistry; sixth, a course in urinary analysis and toxicology. Special students take, in addition to the foregoing, quantitative analysis and laboratory work in organic chemistry.

There is a good laboratory, and a very large proportion of the chemical students are reported as taking a course in it. The laboratory work is wholly optional, and is made as thorough and severe as possible. No researches are reported.

MASSACHUSETTS AGRICULTURAL COLLEGE, AT AMHERST.

Physics.—William B. Graves, M. A., professor of physics and civil engineering. The course in physics is wholly required, and occupies five hours a week for two-thirds of the junior year. It is taught by text book, Atkinson's Ganot, with illustrative lectures. The apparatus is not very complete and there is no provision for a physical laboratory.

Chemistry.—Professor C. A. Goessman, PH. D. In the first third of the freshman year, five hours a week are devoted to lectures and recitations in general and inorganic chemistry. In the first third of the sophomore year organic chemistry is studied. Laboratory practice, from seven to nine hours a week, occupies the second and third junior and the first senior terms. In all, five terms of chemistry are required. The laboratory charge for chemicals is $10 a term with costs for breakage. Instruction is given in both qualitative and quantitative analysis.

The laboratory is also open to special and post graduate students. The latter may select their own subjects of investigation or aid in carrying on the researches of the department, the only restrictions being such as the college resources render necessary. The laboratory hours are from 8.30 A. M. to 12.30 P. M., five days a week.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, AT BOSTON.

In this institution ten regular courses of study are provided, and opportunities for special students not candidates for degrees are offered also. Students from Boston University receive their instruction in chemistry and physics here.

Physics.—Professor C. R. Cross, assisted by S. W. Holman and J. B. Henck, jr. Professor Cross also gives instruction in descriptive astronomy.

At the beginning of their second year in the institute, all candidates for degrees and such other students as may so elect take up the study of physics, a subject which is continued through this and the following year, and for certain professional courses during the fourth year also.

The general principles of physics, including elementary mechanics, are taught through the second year in a course of about ninety lectures. These lectures are annually revised so far as may be necessary to keep pace with the progress of the science, and the discussion of theories is in all cases followed by an explanation of their different practical applications. Exceptionally full experimental illustration is given of all the subjects treated. Atkinson's Ganot is used as a text book supplementary to the lectures, and full notes of the latter are either written upon the blackboard or copied by papyrograph for the use of students.

During the third year a course of fifty practical exercises in the Rogers laboratory of physics is given to all regular students, Pickering's Physical Manipulations being used as the text book. These exercises are preceded by a brief course of lectures upon physical measurements, and are intended to teach the student the use of instruments in general, with special reference to such instruments as are of direct practical value in the arts. They also serve to impress upon his mind many facts which are not readily taught in the lecture room, and to train him to habits of skilful manipulation and accurate observation and reasoning upon the results attained. Students in certain of the courses have additional laboratory work during this year.

In the fourth year, students pursuing courses in chemistry, civil engineering, and architecture receive further instruction in those branches of physics allied to their professional work. For example, the chemists take up advanced work, often original investigation, in heat or electricity; the civil engineers undertake the solution of problems relating to the elasticity and strength of materials, &c. In these exercises the students prepare their own apparatus and conduct an extended series of experiments, submitting a full written report of their work to the professor in charge.

Students who are candidates for a degree in physics pursue a course of study indicated by the following list of subjects:

First year.—First term: Algebra finished, geometry reviewed, general chemistry, rhetoric, English composition, French, mechanical drawing, freehand drawing, military drill. Second term: Plane trigonometry,

spherical trigonometry, general chemistry, qualitative analysis, English history, English literature, French, drawing, military drill.

Second year.—First term: Physics (lectures), analytical geometry, descriptive geometry, qualitative analysis, descriptive astronomy, botany, English history and literature, German. Second term: Physics (lectures), microscopy, calculus, quantitative analysis, physical geography, dynamical geology, English history and literature, German.

Third year.—First term: Physical laboratory, optics or acoustics, mechanics, chemical physiology, chemical laboratory work, constitutional history, German. Second term: Physical laboratory, optics or acoustics, mechanics, advanced physics, history of physical science, chemical philosophy, political economy, German.

Fourth year.—First term: Physical laboratory, electricity, photography and lantern projection, history of physical science, practical astronomy, mechanics, chemical laboratory, chemical applications of physics. Second term: Physical research, optics or acoustics, advanced physics, principles of scientific investigation, advanced mathematics.

These students receive special instruction in general physics during the second, third, and fourth years, using text books in foreign languages whenever it is desirable. An endeavor is also made to accustom them to the use of original memoirs and scientific periodicals, by an exercise in which members of the class in turn prepare papers upon subjects specially assigned to them. The fourth year is largely devoted to special work, generally of the nature of original research.

The physical laboratory is remarkably well equipped, and was the first of its kind organized in this country. The institute was opened in 1865. A considerable number of original researches in physics have been published by professors and students, but no list of them has been reported.

Chemistry.—J. M. Ordway, professor of metallurgy and industrial chemistry; J. M. Crafts (now absent in Europe), professor of organic chemistry; W. R. Nichols, professor of general chemistry; C. H. Wing, professor of analytical chemistry; Ellen H. Richards, instructor in chemistry and mineralogy in the woman's laboratory; A. H. Lowe, F. H. Morgan, and T. F. Stimpson, assistants. Assaying is taught by R. H. Richards and Professor Ordway gives instruction in botany and biology. The biology, however, is partly a chemical subject.

A certain amount of chemistry is required of all students who are candidates for degrees, namely, all the inorganic portion of Eliot and Storer's Elementary Manual, and, in qualitative analysis, a knowledge of general methods, with the ability to identify the various metallic elements in simple compounds and to prove the presence or absence of the commoner acids. Both general chemistry and qualitative analysis are taught by lectures and laboratory practice during the first school year. Students who pursue courses in chemistry, mining, metallurgy, physics,

or natural history continue the study of qualitative analysis in their second year, the laboratory work being supplemented by lectures. In the second term of the same year they take up quantitative analysis. Chemical philosophy is taught to the students in chemistry and physics, partly by lectures and partly by recitations upon the basis of Cooke's text book. Strictly chemical students follow the preceding course with the study of organic chemistry, Schorlemmer's work being used as a basis for the lecture room exercises. Parallel with the latter there is a course of laboratory instruction, and some organic research is usually undertaken as thesis work. Other lines of investigation may, however, be chosen. Industrial chemistry is taught by lectures and laboratory practice, and instruction in physiological chemistry is also provided.

Candidates for a degree in chemistry have three courses of study open to them, all being identical in the first year with the course already described under physics. Course A runs as follows:

Second year.—First term: Qualitative analysis, analytical geometry, physics, English history and literature, German. Second term: Quantitative analysis, chemical philosophy, differential calculus, physics, English history and literature, German.

Third year.—First term: Quantitative analysis, microscopy, physical laboratory, constitutional history, German. Second term: Quantitative analysis, industrial chemistry, drawing, physical geography, dynamical geology, physical laboratory, political economy, German.

Fourth year.—First term: Organic chemistry, metallurgy, history of chemistry and allied sciences, abstracts of memoirs, applied physics, optional studies. Second term: Studies for this term, including thesis work, are specially assigned to each student.

In courses B and C mathematics is dropped at the close of the first year, being replaced by the natural sciences. Course B is for students who prefer a larger amount of the last named studies and course C for those who intend to pursue industrial chemistry. The laboratories for qualitative and quantitative analysis were established in 1865. That for organic chemistry was started in 1877. The laboratory for industrial chemistry has been equipped during the past year—1878–'79. No list of researches has been prepared, although a considerable amount of good work has issued from the institute.

The Woman's Laboratory.—In immediate connection with the Institute of Technology, and under the special patronage of the Woman's Education Association, is the Woman's Laboratory, which deserves particular mention. The history of its origin, growth, and work forms an important chapter in the history of chemical teaching. In 1867, among the Lowell free lectures given at the institute, were two courses in chemistry by Professors Eliot and Storer, open to both sexes. In 1868 laboratory exercises were given instead of lectures; and these continued, with the exception of one year, until 1877. About 1870 the laboratory at the Girls' High School, in Boston, was put in working order; and in

the five years from 1868 to 1873 laboratory instruction in chemistry made rapid advances in the schools of New England. During this time some fifteen female teachers availed themselves annually of the Lowell courses at the institute, several of them attending for two successive years in order to get both general chemistry and qualitative analysis. Others who were not teachers attended also. In the winter of 1872–'73 an intermission in the Lowell courses occurred; and at the same time a young woman from a medical college applied for instruction in analysis at the institute. She could not be accommodated in the already crowded laboratory; but Professor Crafts, interested in the matter, sought for facilities elsewhere. With the coöperation of Dr. Samuel Eliot, head master of the Girls' High School, the consent of the authorities to use the well equipped laboratory of the latter institution was obtained. A short course in analysis was given by Mrs. Ellen H. Richards and Miss Bessie T. Capen, under the direction of Professor Crafts, and, through the interest of Dr. Eliot, the Woman's Education Association furnished the necessary funds. The class numbered sixteen students.

In the next winter the Lowell class was resumed; and, as the interest in chemistry increased, Professor Nichols offered a course in quantitative analysis for those teachers and others who had already profited by the more elementary instruction of previous years. This was probably the first course of the kind ever opened to women; and in 1875 five availed themselves of it. At this period Harvard University opened its summer school of chemistry; other colleges followed the example, and the desire for instruction in this department was naturally stimulated. In fact, the demand was so urgent that in 1876 the professors of chemistry in the institute provided for eight women in their own private laboratory, fitting it up at their own expense and giving what instruction they could freely. A small fee was charged, barely enough to cover the cost of gas and water.

In the same year there came from President Runkle, of the Institute, a proposition to furnish space for a woman's laboratory in the gymnasium building. This was accepted by the Woman's Education Association. A circular was issued asking for two thousand dollars with which to provide equipment, and within three weeks the money was subscribed. There were also gifts of valuable instruments. During the summer the space assigned to the laboratory was changed from that indicated in the original plan to the front portion of the special building erected for the school of mechanic arts. This change gave greater room, but involved increased expense, and in 1877 the Woman's Education Association contributed an additional $500.

In November, 1876, the laboratory was opened to students. It consists of five rooms, three of them for women exclusively, namely, the chemical laboratory, the combined library and weighing room, and the reception room. The industrial and optical laboratories are shared with

the students of the institute, although the instruments in them belong to the woman's department.

In the first two years of its existence the laboratory furnished instruction to forty-three women, about two-thirds of whom were either teachers or preparing to teach. Among them were teachers from ten institutions in Massachusetts, two colleges (Smith and Wellesley), three seminaries, three high schools, and two private schools. The methods of instruction are at present adapted to the individual and to the time at her disposal, and for ten years to come the teaching must be largely of this special character. Some research work has already been done in the laboratory, and the published results have found their way into standard scientific literature. A list of these researches has not, however, been reported.

The promoters of this enterprise wisely urge the importance of chemistry to women, even to those who are neither teachers nor specially scientific in tastes. To every head of a household there are chemical subjects which are necessarily interesting and of which a knowledge is often useful. The cleansing and dyeing of various fabrics, the chemistry of culinary processes and of fermentation, the use and abuse of soda, the manufacture of such articles as glass and pottery, the detection of adulterations in foods and drinks—all these are illustrations showing the truth of the foregoing proposition.[1]

The following rates of tuition are charged in the laboratory for each full school year of eight months: six days in the week, $200; two days in the week, $80; one day in the week, $45.

For less than three months the rates are proportionally somewhat higher. The laboratory is in charge of Professor Ordway and Mrs. Richards.

BOSTON UNIVERSITY, AT BOSTON.

College of Liberal Arts.

The students of physics and chemistry at this institution receive their instruction in the laboratories and lecture rooms of the Massachusetts Institute of Technology from the regular professors of the latter school. The courses of study are, however, specially arranged for university classes. Both chemistry and physics, as represented by Roscoe's and Stewart's Primers, respectively, are required for admission to the College of Liberal Arts.

Physics.—Professor C. R. Cross. Lectures and laboratory work are required through the second and third sophomore terms, five hours weekly.

Chemistry.—Professor W. R. Nichols. Required, six hours a week, in the first junior term; elective, two hours a week, in the second and third junior terms.

[1] This account of the woman's laboratory is condensed from a report made by Mrs. Richards to Edward Atkinson, esq., secretary of the committee on subscriptions.

The character of the foregoing work is probably indicated by the returns from the Massachusetts Institute of Technology. Post graduate courses of study are also arranged for by the university. No original research work is reported.

HARVARD UNIVERSITY, AT CAMBRIDGE.

I.—*Harvard College.*

Physics.—Professors, Joseph Lovering and Wolcott Gibbs: assistant professor, John Trowbridge; tutor, R. W. Willson: N. D. C. Hodges, assistant. Elementary physics is among the requirements for admission. In the freshman year, physics is a prescribed study. The "minimum sections" study mechanics, hydrostatics, pneumatics, and light, twice a week, under Mr. Willson. The "maximum" sections have general physics under Mr. Hodges. After the freshman year the following elective courses are offered:

(1) Astronomy, optics, and acoustics. Twice a week. Professor Lovering. This may be taken three times a week by students so desiring.

(2) Practical exercises in the laboratory, including the use of instruments of precision in testing the laws of mechanics, acoustics, optics, magnetism, and electricity, and an extended course in electrical measurements. Three times a week. Assistant Professor Trowbridge.

(3) The conservation of energy. Recitations and lectures. Twice a week. Assistant Professor Trowbridge.

(4) Undulatory theory of light. Electricity and magnetism. Three times a week. Professor Lovering.

(5) The spectroscope and its applications. Thermodynamics and thermics, including the applications of heat. Three times a week. Professor Gibbs.

Candidates for honors in physics must take courses 2, 4, and 5.

For graduate students two other courses in physics are offered, as follows, both under Assistant Professor Trowbridge:

(1) Experimental physics, with laboratory work, for advanced students. Three times a week.

(2) Mathematical physics. (Maxwell's Electricity and Magnetism.) Three times a week.

Chemistry.—Josiah P. Cooke, professor of chemistry and mineralogy; C. L. Jackson and H. B. Hill, assistant professors of chemistry; instructor, H. B. Hodges; C. F. Mabery, J. F. White, and C W. Andrews, assistants. Elementary chemistry is one of the requirements for admission.

The only chemistry obligatory upon undergraduates is a course of twenty popular elementary lectures delivered, once a week, by Professor Cooke to the freshmen. This course is, however, a very important means of recruiting the elective classes, since a large part of the success of the department depends upon interesting the freshmen. The whole class

are required to pass an examination, nominally on the lectures, actually upon Professor Cooke's New Chemistry, excepting the first and the last chapters. This plan of lecturing in such a way as to interest the students, and then of setting them a definite task to get up for examination, is found to work very well. The result is as good as if a text book had been gone over lesson by lesson, and the class like the work a great deal better.

After the freshman year the following elective courses are offered:

(1) Descriptive chemistry, with laboratory work. Three times a week. Assistant Professor Jackson. The course as a whole consists of two lectures, one recitation, and four hours of laboratory work a week. The laboratory work is laid out for each exercise at the preceding lecture, and involves numerous experiments in practical chemistry. This course is intended for general education and is taken by more than half of every class. The average number of students annually in attendance upon it is reported as one hundred.

(2) Determinative mineralogy and lithology, with study in the mineral cabinet. Three times a week. Professor Cooke and Mr. Melville. The mineralogy, including descriptive crystallography and blowpiping, is taught first by lectures on models and specimens, and later by practical exercises in determining minerals. Over two hundred drawers of specimens are selected for this purpose and assigned to the students. Their acquirements are tested by calling on them to point out on the specimens the characteristics by which the latter have been determined. The examination refers solely to their ability to identify species. About thirty students take this work.

(3) Qualitative analysis and chemical philosophy, with laboratory work. Three times a week. Assistant Professor Hill. Qualitative analysis is taught in much the usual way. Three hours a week means a minimun of nine hours' work in the laboratory. Most students work much more. About forty students take this work.

(4) Quantitative analysis. Three times a week, or a minimum of nine hours in the laboratory. Professor Cooke and Mr. Hodges. In this course, as in the last, some preliminary instruction is given by lectures. About twenty students attend.

(5) The carbon compounds. Three times a week. Assistant Professor Hill. This is an advanced course of lectures on theoretical organic chemistry, accompanied by work in the laboratory. The latter is chiefly in the preparation of organic products, although, as soon as the students show themselves competent, they are started on research.

(6) Advanced course in exerimental chemistry. Three times a week. Professor Cooke. This is a continuation of earlier work, and here also students, as soon as they have acquired sufficient skill, are set at research. The instruction is all special and in the laboratory.

(7) Crystallography and the physics of crystals, with work in the

mineral cabinet. Professor Cooke. Instruction is given by lectures, Miller's system being taught.

Candidates for honors in chemistry must take at least twelve hours a week from among these electives.

For graduate students there is a course in advanced organic chemistry, three times a week, under Assistant Professor Hill. In the laboratories advanced students are also directed by the professors in whatever special studies or investigations they may desire to undertake.

But little use is made of text books, their day having gone by. Indeed, there are no formal recitations except in courses 1 and 3, and in these they are directed rather to emphasize the lectures or to correct inaccuracies than to enforce the learning of lessons.

The laboratory facilities, &c., are as follows: First, a qualitative laboratory, with one hundred desks; then a quantitative laboratory, with twenty-four desks, an organic laboratory, with twelve desks, and a mineralogical laboratory capable of accommodating about twenty-four students. There is a room of constant temperature for gas analysis, with a furnace room, a balance room and library, a larger and a smaller lecture room, and three private laboratories. The apparatus is ample, and the mineral cabinet is abundantly sufficient for all purposes of teaching. Every opportunity is afforded for research.

II.—*The Lawrence Scientific School.*

In this school the work in chemistry and physics is almost identical with that offered by the college. The full course in chemistry leading to the B. S. degree is, with collateral studies, as follows:

First year.—Descriptive chemistry, with laboratory work, three times a week; elementary physics, one lecture a week; French or German, three times a week; qualitative analysis, eighteen hours a week in the first half year; quantitative analysis, eighteen hours a week in the second half year.

Second year.—Technological chemistry, recitations, and excursions, three times a week; elementary physics, one lecture a week; German scientific prose, twice a week; quantitative analysis (including assaying, gas and water analysis, and the more important commercial tests), twenty hours a week.

Third year.—Physics. Practical exercises in the laboratory. (See course 3 in physics under Harvard College.) French scientific prose, twice a week; determinative mineralogy and lithology, three times a week; organic chemistry, with laboratory work, eighteen hours a week.

Fourth year.—Crystallography and the physics of crystals, three times a week; mechanical drawing, four hours a week; laboratory work, twenty-three hours a week in the preparation of a thesis.

At present no students are reported in the university catalogue as taking the above course. In the other scientific school courses varying amounts of work in chemistry and physics are put down. A reference

to the elective classes described in connection with the college will indicate the character of the work which is possible to be taken.

III.—*The summer course in chemistry.*

For seven years a course of instruction in chemistry has been given during the summer vacation. This course is for the benefit of teachers, irrespective of sex, and has been largely attended. The subjects taught are general chemistry, qualitative analysis, quantitative and organic analysis, the preparation of chemical substances, mineralogy, crystallography, and blowpipe analysis.

In 1879 this course was conducted by Mr. C. F. Mabery, assisted by W. Z. Bennett and J. F. White. The laboratories were open five days and a half each week from July 7 to August 16. Thirty students attended. The several subjects were presented by lectures in which the extensive apparatus and collections of the university were available. The students were given every facility in the laboratory. The fee for this course is $25, besides a small charge for chemicals, breakage, and the use of apparatus.

IV.—*The Bussey Institution, at Jamaica Plain.*

In this institution, which is the agricultural and horticultural school of Harvard University, agricultural chemistry is taught by Professor F. H. Storer. During the first year there are two exercises a week in this subject, each an hour and a half long; also, two a week in the second year, the lessons varying from one-half hour to two hours' duration. To students who have had laboratory practice in qualitative analysis, quantitative analysis is taught. This requires three half days or more each week, and embraces methods of analyzing rocks, manures, plants, milk, &c., and of investigating problems in agricultural chemistry. Students who wish it have one afternoon a week in determinative mineralogy. The courses in other departments of the university are also open to students of this school.

The history of instruction in chemistry at Harvard University dates back to 1782, when Aaron Dexter became professor of chemistry and materia medica. He occupied the chair until 1816. In 1791 Maj. William Erving endowed the professorship of chemistry with the sum of one thousand pounds, and it has since borne his name. Professor Dexter was followed by John Gorham, who held the position until his death, in 1827. Dr. Gorham, in 1819, published a work in two volumes octavo, upon The Elements of Chemical Science. This was the first systematic treatise upon chemistry by an American author.

In 1847 the Lawrence Scientific School was organized; and, under Prof. E. N. Horsford, laboratory instruction began. This marks an era in the history of American science. Many of our best teachers of chemistry have been trained in this school; and the long series of "Contribu-

tions to Chemistry," published from its laboratory, represents some of the most important researches which have been carried out in America. From 1861 until 1863 the laboratory was in charge of Assistant Professor Charles W. Eliot, now president of the University. In 1863 Dr. Wolcott Gibbs entered upon his duties as the successor of Professor Horsford in the Rumford professorship, and to him was assigned the chemical work of the Scientific School. From this date down to 1871 the school easily held its own as the foremost school of chemistry in this country, and it was during this period that the greater number of the researches above referred to were made. In 1871 the special laboratory was abolished, the chemical instruction was consolidated with that of the college, and Dr. Gibbs became professor of physics, which position he still holds. At about the same time the special physical laboratory, in charge of Assistant Professor Trowbridge, was established. This laboratory is used both by scientific students and students in the college. The apparatus for light and heat is in a separate building, under the special direction of Dr. Gibbs.

In 1850 Professor Cooke was elected to the Erving professorship in Harvard College. In 1854, in the basement of University Hall, the first laboratory instruction for undergraduates was given. Such instruction was not, however, formally recognized as a part of the college course until 1859, when the present laboratory building was completed. This building was erected with funds raised by subscription; and in the circular soliciting means Professor Cooke distinctly set forth the importance of laboratory teaching, and indicated that as one of the chief objects in the enterprise. From his first connection with the department in 1850, Professor Cooke had this purpose in view; but there was much prejudice to be overcome and long established methods had to be set aside before success could be gained. The laboratory work was at first wholly a voluntary exercise, and it was not until its usefulness had been demonstrated by actual results that a footing could be obtained for it in the college course. At the start it was only allowed as an elective in place of modern languages, which themselves had been electives from an early period. When, however, the elective system extended to other studies, experimental chemistry found its proper place, and has since been steadily gaining in favor.

Many researches in chemistry and physics have been published from Harvard University, but no list of them has been submitted. Among them we find much of the best work of Gibbs, Cooke, Lovering, Trowbridge, Hill, Jackson, and many others, students or teachers.

TUFTS COLLEGE, AT COLLEGE HILL.

Physics.—A. E. Dolbear, professor of physics and astronomy. In the latter half of the sophomore year there are three recitations a week in Goodeve's Mechanics. Through the junior year, also, three times a week, general physics is taught from a variety of text books, and is

illustrated by an abundance of experiments. The solving of problems is given due prominence in the work.

From the foundation of the college in 1853 until 1875, physics was taught wholly by lectures and recitations. In the latter year a physical laboratory was organized, and in this the students have facilities for much elective work. In the school year 1878–'79, twenty-five scholars took a laboratory course, spending from two to twelve hours a week on the experiments. The course is based mainly upon Pickering's Physical Manipulations, and covers such ground as the determination of gravity by the pendulum, the verification of the focal length of lenses, the comparison of thermometers, electrical measurements, and so on. In the discussion of results the method of least squares is much employed. Any student who exhibits special ability is encouraged to undertake some new work or to solve some problem in which he devises as far as possible the needed apparatus, while the instructor simply sees to it that he does not waste his time by attempts in wrong directions.

Professor Dolbear reports (but without giving titles or places of publication) researches upon telephony, a new galvanometer, a new electric lamp, and a new filter pump.

Chemistry.— S. M. Pitman, professor. Inorganic descriptive chemistry, with accompanying laboratory work, is required of every student through about three-fourths of the junior year. Text book, Thorpe. Lectures on general and organic chemistry are also given; and at the same time, as an elective, there is a full course in qualitative analysis in the laboratory. During the senior year, quantitative analysis, twenty hours a week, is elective. Text book for quantitative work, Thorpe; for qualitative, Clowes. In place of the latter book, students who spend but little time in the laboratory may use either Appleton's, Thorpe's, or Crafts's qualitative analysis.

Chemistry has been taught in Tufts College from the date of its foundation. A laboratory for ordinary manipulation was opened in 1872, qualitative analysis began in 1874, and quantitative analysis in 1875.

SMITH COLLEGE, AT NORTHAMPTON.

Physics.—Professor J. T. Stoddard. Required through the greater part of the junior year: six hours a week during the last eight weeks of the first term, four hours a week for the rest of the time. Instruction is given by means of experimental lectures and recitations, the text book, Atkinson's Ganot, being used as a work of reference only. The class are furnished with printed abstracts of each lecture.

In the first senior term there is an elective in physics of four hours a week. This course is offered for the first time this year. The work in it consists mainly of laboratory practice.

Chemistry.— Miss Bessie T. Capen, teacher. Taught as a prescribed study, from Eliot and Storer's Manual, with laboratory practice four

hours a week during the first sophomore term. From this point on to the end of the college course analytical chemistry may be taken as an elective. Both qualitative and quantitative analysis are taught. The laboratory has accommodations for fifty students. A charge is made for chemicals and breakage.

WELLESLEY COLLEGE, AT WELLESLEY.

Physics.—This study is taken up in the junior year. A two years' course of instruction is provided, one year only being prescribed and the other optional. The work consists of lectures, recitations, and laboratory exercises, the text books being Atkinson's Ganot and Pickering's Physical Manipulations. In the first year the foundation doctrines of motion, force, and energy, as applied to visible masses, are discussed; and subsequently the branches of sound, light, heat, electricity, and magnetism are taken up. The laboratory is admirably equipped, and in it the students are required to make accurate physical measurements and to discuss their results. The quantitative verification of physical laws is also involved in these exercises. The work of the second year is largely in the laboratory, embracing more extended and more difficult experiments, which are worked up by analytical methods with the use of the calculus. A very full account of the scheme of laboratory practice is given in the college catalogue. The whole course is well adapted to stimulate the spirit of original research among the students; although it is too recently established to have produced as yet any fruits in this direction. The professor of physics teaches also astronomy.

Chemistry.—The professor of chemistry has also charge of mineralogy. One year of study is prescribed, which includes laboratory work. A second year's optional course is also provided. In the first year general chemistry is taken up, including some portions of chemical physics. No text book is used, but full notes of the lectures are required, and the students also keep a record of their laboratory work. In the latter, the usual elementary exercises are performed, followed by a course in qualitative analysis. Further than this point the work has not yet been carried; although the scheme of study is intended to cover eventually quantitative analysis and organic chemistry.

The laboratory at present is small. There are twenty-four working tables, which are intended to accommodate ninety-six students working in divisions. No charge is made to students for the use of apparatus or chemicals, but they are required to pay cost price for breakages.

WILLIAMS COLLEGE, AT WILLIAMSTOWN.

Physics.—T. H. Safford, professor of astronomy and physics (.M. Dodd, professor of mathematics and mechanics. The instruction is wholly prescribed, and occupies two terms in the junior year: one term of mechanics and the second in general and molecular physics. Laboratory work is permitted, but not required, and some credit is given

for it upon the scale of rank. Norton's Natural Philosophy is used as a text book, with additions by the professor.

Chemistry.—Professor M. S. Southworth. Taught for one junior term, by experimental lectures and recitations from Nichols's abridgment of Eliot and Storer's Manual. There is no opportunity for regular laboratory work, but interested students may assist the professor. For the latter, a small laboratory is provided. In former years some important researches were carried out at this college by Professors A. W. Wright and Ira Remsen.

A professor of mathematics and natural philosophy was appointed here as early as 1803. Chemistry was introduced by Chester Dewey, who was professor here from 1810 to 1827. Prof. Edward Lasell, appointed in 1834, was probably the first regular instructor in chemistry. Up to two years ago chemistry and physics were taught by one and the same professor; but the chair is now divided.

WORCESTER COUNTY FREE INSTITUTE OF INDUSTRIAL SCIENCE, AT WORCESTER.

Physics.—Professor A. S. Kimball. Required of all students through the second and third years of a three years' course. The work consists of eighty recitations in Stewart's Physics, eighty recitations in Zeuner's Théorie mécanique de la chaleur, and a series of exercises in the physical laboratory. The latter includes experiments upon specific and latent heat, the tension of vapors, the testing machine, dynamometer, and steam engine indicator, the trial of boilers for efficiency and economy, and so on. In short, as indicated by the report, the laboratory work in physics bears much more upon applied science than upon pure science.

Chemistry.—Taught by the principal, C. O. Thompson, assisted by Mr. Walter U. Barnes. Required of all students through the first year, the latter half of the second year, and the first half of the third year. In the first half of the first year there are twenty introductory lectures, followed by ten laboratory exercises in manipulation of two hours each. These exercises advance from the standpoint of the twentieth lecture. In the second half of the year the class recite in Barker's College Chemistry from the beginning through "carbon" triweekly for twenty weeks. In the latter half of the second year there are forty two-hour lessons semiweekly in wet analysis. In the senior year, first half, there are forty lessons in blowpipe analysis and determinative mineralogy, accompanied by twenty lectures upon organic chemistry. The charge for the laboratory practice above indicated is $7 per annum.

For students who intend to become practical chemists there is a larger amount of laboratory work, covering quantitative analysis, both gravimetric and volumetric, blowpipe and furnace assaying, and thesis work. The laboratory fee for such students is $14 per annum.

The following investigations are reported from this institute: By Professor C. O. Thompson, a "Report on the effect of confervoid plants

upon drinking water" and a "Report on a sample of mineral water from Clinton, Mass."—both of these reports were made to Phinehas Ball, engineer of Springfield, Mass., water works; "Gas from gasoline," American Chemist, July, 1875. By Professor A. S. Kimball, "Friction on an inclined plane," Amer. Jour. Sci., March, 1876; "Changes in the physical properties of steel produced by tempering," Amer. Jour. Sci., August, 1876; "A new investigation of one of the laws of friction," Amer. Jour. Sci., May, 1877; "On journal friction at low speeds," Amer. Jour. Sci., March, 1878. By Miss Mary F. Reed, "Study of the quantitative effect of temperature upon the reaction of oxalic acid upon potassic permanganate," Amer. Chemist, April, 1875.

RHODE ISLAND.

BROWN UNIVERSITY, AT PROVIDENCE.

Physics.—Professor, E. W. Blake, jr. The following course is required: Mechanics, five times a week through the latter half of the sophomore year. Recitations from Peck's Mechanics, with experimental illustrations. In the first half of the junior year, sound, light, heat, and electricity are taught, partly by recitations and partly by experimental lectures, five times weekly.

Laboratory practice is optional, from three to ten hours a week, in the latter half of the junior year. In this course the students perform some of the more important physical measurements and manipulations, and learn the use and care of apparatus. The laboratory is small, so that only a very few students can work in it. These are selected from the considerably larger number who apply, on the ground of satisfactory progress in the preceding terms. Attached to the laboratory there is a workroom with lathes, a metal planer, and tools for metal working. The outfit of apparatus for lecture purposes is good, and efforts are being made to secure a larger equipment and better facilities for laboratory work.

Under the title of the "Howell premium" the income of a fund of one thousand dollars is given, at the close of the first half of the junior year, to the student "who, having a good record of deportment, has the highest rank in mathematics and natural philosophy."

It should also be added that the chair of physics was specially endowed by Hon. R. G. Hazard and his son, R. Hazard; and that it is therefore known as the "Hazard professorship."

Chemistry.—Professor, J. H. Appleton, assisted by Edwin E. Calder. In the first half of the junior year there are three exercises a week in general chemistry. In all, this makes sixty lectures, which are illustrated by experiments, charts, and diagrams. The students are required to take notes, and at the beginning of each exercise they are questioned upon the two preceding lectures. They are also obliged to write chem-

ical reactions and to solve stoichiometrical problems on the blackboard. This course of study is required of all students candidates for degrees.

The foregoing relates to the usual course in arts. The university also provides two courses leading to the degree of bachelor of philosophy. In one of these, which includes an ancient language, the work in chemistry is the same as that given above. In the other course, containing no ancient language, the same chemistry is required in the first half of the freshman year, with, additional, five hours a week of analytical chemistry in the second half. In this course analytical chemistry may be continued as an elective to the end of the senior year.

Upon concluding the prescribed course of study students may be admitted to elective work in the laboratory, which can cover as much as one and a half years. Each year is reckoned at forty weeks, and the regular work is ten hours a week. In the laboratory analytical chemistry is chiefly taught, but attention is also given to metallurgy, pharmacy, medical chemistry, agricultural chemistry, and applied chemistry. There are also lectures in connection with the laboratory practice. Instruction is not confined to undergraduates; but other persons who are properly grounded in elementary chemistry may be admitted to work in the laboratory.

The chemical department occupies a separate brick and stone building, about eighty by fifty feet, partly two and a half and partly one and a half stories high, which was built exclusively for its purposes. The charges to a student who works two hours daily in the laboratory average for each half year about thirty-eight dollars, which covers extra tuition, gas, chemicals, and breakage. For four or six hours daily, double or treble this charge is made; but post graduate students are allowed reduced rates.

TORPEDO STATION, AT NEWPORT.

The course of instruction here given to naval officers is described in connection with the work of the United States Naval Academy, at Annapolis.

CONNECTICUT.

TRINITY COLLEGE, AT HARTFORD.

Physics.—Taught by Professor John Brocklesby, who also has charge of meteorology and astronomy. The study is wholly prescribed, and covers five hours a week through the junior year. Text book, Ganot. Experiments are performed before the class, but there is no laboratory work on their part.

Chemistry.—Taught by Professor H. Carrington Bolton, who also gives instruction in mineralogy, geology, and vegetable physiology. Chemistry is entirely a prescribed study, and the students meet the professor five hours a week through the senior year. Lectures are also given upon the history of chemistry. There is an excellent laboratory

for the use of the teacher, but there are no facilities as yet for laboratory work by students. Two prizes, of thirty and twenty dollars respectively, are annually awarded to members of the class for the best essays upon a prescribed chemical subject.

Both studies were introduced into Trinity College at the time of its foundation, in 1823–1824. Since Professor Bolton became connected with the institution he has published one original research, "Behavior of natural sulphides with iodine and other reagents," printed in the Annals of the New York Academy of Sciences for 1878.

WESLEYAN UNIVERSITY, AT MIDDLETOWN.

Physics.—In charge of J. M. Van Vleck, professor of mathematics and astronomy, who is aided by a tutor in mathematics and by an assistant, J. C. Burke, in physics. Prescribed in the classical course, five times a week, during the second and third sophomore terms. Elective, five hours a fortnight, in the junior year. In the scientific and Latin-scientific courses the entire foregoing amount is obligatory; only in the former course the work begins during the freshman year. Text books, Wood's Mechanics and Deschanel. It is expected that a physical laboratory will be organized within the coming year.

Chemistry.—Professor W. O. Atwater, with one assistant. Elementary chemistry is taught, six hours a week, for one term, by lectures and laboratory practice. This work is obligatory in all the courses, the classical students taking it in the junior year, the Latin-scientific students in the sophomore year, and the scientific students in the freshman year. Text books, Eliot and Storer and Roscoe. About two-thirds of the time is devoted to inorganic and one-third to organic chemistry. The compulsory laboratory practice was introduced about five years ago, and has given satisfactory results.

Analytical chemistry, both qualitative and quantitative, is elective, five times a fortnight, during the junior and senior years of the classical course. In the Latin-scientific and scientific courses it is prescribed, for the former in the junior, for the latter in the sophomore year. It may be continued as an elective up to graduation. Determinative mineralogy is taught as an elective in all the courses. Laboratory students are charged for chemicals and apparatus, but the amount ought not to exceed twenty dollars a term. A prize, which is annually awarded for excellence in "natural science," will this year be given upon an examination in chemistry. Extra laboratory work is encouraged, and may branch into physiological, mineralogical, and other special lines.

Considerable research work is going on at this laboratory, though not all of it has yet been published. A paper by Professor Atwater and G. Warnecke, "On the quantitative estimation of fats," appeared in the Journal of the American Chemical Society, II, 85; also, several papers upon topics in agricultural chemistry in the "Report of work of the agricultural experiment station, Middletown, Conn., 1877–'78."

YALE COLLEGE, AT NEW HAVEN.

Elias Loomis, professor of natural philosophy and astronomy; Benjamin Silliman, professor of chemistry; Chester S. Lyman, professor of astronomy and physics; Samuel W. Johnson, professor of theoretical and agricultural chemistry; J. W. Gibbs, professor of mathematical physics; Arthur W. Wright, professor of molecular physics and chemistry; O. D. Allen, professor of analytical chemistry and metallurgy; W. G. Mixter, professor of chemistry; E. S. Dana, tutor in physics and curator of the mineralogical collection; S. L. Penfield, assistant in analytical chemistry; W. T. Sedgwick, instructor in physiological chemistry. Lectures upon thermodynamics are also given by Professor A. J. DuBois, and Professor G. J. Brush has charge of mineralogy. Analytical and applied mechanics are taught as mathematical subjects by Professors H. A. Newton, W. A. Norton, and J. E. Clark.

Department of philosophy and the arts.—Post graduate instruction.

The teaching in this department includes both theoretical and practical work, and in the latter the exercises may extend continuously through two college years. The courses of instruction announced in the catalogue of 1878–'79 are as follows: Professor Newton, analytical mechanics; Professor Clark, analytical mechanics; Professor Norton, applied mechanics; Professor Gibbs, the laws of vibratory and undulatory motion, with especial reference to light and sound; the potential function, with its application to the theories of electricity and magnetism; capillarity; Professor DuBois, thermodynamics; Professor Lyman, astronomical spectroscopy; Professor Wright, physical manipulation in the departments of heat, light, and electricity, with practical directions as to the management of apparatus; Professor Johnson, theoretical and analytical chemistry; Professor Johnson, agricultural chemistry; Professor Allen, analytical chemistry; Professor Allen, metallurgy and assaying.

Undergraduate academical department.

Physics.—This subject is begun in the last third of the sophomore year, and continued throughout the junior year. It is a required study for this time, the number of exercises varying from three to five a week. It is taught both by recitations and lectures, and the work includes several detailed examinations. The study is continued through the last two-thirds of the senior year as an optional, the exercises being practical work in the physical laboratory, and, preparatory to or collateral with them, some recitations and informal lectures. The instruction at present is given by two professors and one assistant professor.

Chemistry.—Instruction is given by one professor in the first third of the junior year, by recitations, lectures, illustrative exercises with problems, and examinations. There is no laboratory practice.

Physics.—Taught through the whole of the first year to all regular students in much the same way as in the academical department. Afterwards it is a special study. Instructors, one professor and one assistant. A prize is given for excellence in physics.

Chemistry.—Instruction is given by three professors and two assistants. There are several three years' courses of study, all of which are the same in the first year. The "course in chemistry" is as follows:

Freshman year.—First term: German, English, analytical geometry, physics, elementary drawing, chemistry (recitations and laboratory practice). Second term: Language, physics, and chemistry (as above), spherical trigonometry, elements of mechanics, botany, physical geography, political economy, drawing.

Junior year.—First term: Theoretical and organic chemistry, lectures, qualitative analysis, blowpipe analysis, German, French. Second term: Quantitative analysis, mineralogy, blowpipe analysis and determination of species, French, German.

Senior year.—First term: Volumetric and organic analysis, geology, zoölogy, French. Second term: Mineral analysis and assaying, agricultural chemistry, recitations and lectures (optional), geology, metallurgy (optional), mineralogy (optional), French.

Blowpipe analysis is taught in all the regular courses. In the engineering courses this study is taken by the seniors. Other courses have it in the junior year. Students in the courses of "natural history" and "biology" have instruction in qualitative analysis during the first junior term. In the latter course toxicology and physiological chemistry are taught through the second junior term. Juniors in the agricultural course take the chemistry assigned for the same time to the chemical students, as specified above. In the senior year they have agricultural chemistry. Young men wishing to become mining engineers can pursue the regular course in civil or mechanical engineering, and afterwards can spend a fourth year studying metallurgical chemistry, mineralogy, &c.

The laboratories are well provided with all necessary facilities. A fee of $5 is charged to members of the freshman class for chemicals, &c., and the same fee is required from all who take the practical exercises in blowpipe analysis and determinative mineralogy. The special student of chemistry, over and above tuition fees, pays $70 per annum for chemicals and the use of apparatus. He also supplies himself at his own expense with gas, flasks, crucibles, &c., the cost of which should not exceed $10 a term.

A prize is given for excellence in chemistry. A good deal of original research work is done by teachers and advanced students, and a very large number of scientific memoirs have been published from the school. Probably no institution in America can surpass the record of the Sheffield Scientific School in this respect.

In the history of American science, Yale has played a very prominent part. Previous to 1770 both chemistry and physics had been taught by tutors, as they were called; but in this year the first professor of physical science was appointed. His title was "professor of mathematics, natural philosophy, and astronomy." In 1836 the professorship was replaced by two others, namely, a chair of mathematics and one of natural philosophy and astronomy. The latter continues to the present day. In 1871 a professor of mathematical physics and a professor of molecular physics were appointed; and in 1879 an assistant professorship in natural philosophy was established. Practical physics was taught for many years as an occasional thing to special students or to professors' assistants, but was not made a part of the regular course of instruction until 1871. It was then formally introduced as an optional study in the academical department and in the course for graduates.

Instruction in chemistry was not given as a regular thing before the beginning of the present century. The manuscript notes of the elder Professor Silliman state that the professor of natural philosophy sometimes introduced chemical topics in his lectures and was familiar with the chemical literature of the day. This was while Silliman himself was a student in college, during the years 1792 to 1796. In 1798 the corporation voted to institute a professorship of chemistry and natural history as soon as it could be provided for. The chair was actually established in 1802, and Professor Silliman, who had previously been tutor for some time, was appointed to fill it. His first lecture was given in 1804, and for nearly fifty years he continued to give instruction in these subjects. During this time he had the assistance of private students, but there were no opportunities for general instruction in analytical chemistry. In 1818 he issued the first number of the American Journal of Science, a journal which is still living and vigorous, and which has for many years given American men of science almost their best medium for publishing their discoveries. This enterprise reflects the greatest honor upon its founder and through him upon the institution with which he was connected.

In 1846 a scheme was adopted by the corporation for furnishing laboratory instruction, and two professors were appointed. These were J. P. Norton, for agricultural chemistry, and B. Silliman, jr., for technical chemistry. To the latter title was afterwards added the word "general." This movement was the beginning of the scientific school, which, by the gifts of Mr. Sheffield in 1859 and later, was placed upon a permanent basis. In 1863, by act of the legislature, the school received the national land grant, and thus became the College of Agriculture and Mechanic Arts of Connecticut.

NEW YORK.

In addition to the colleges especially described below, returns were received from St. Stephen's College at Annandale, Canisius College at

Buffalo, St. Lawrence University at Canton, Hobart College at Geneva, Madison University at Hamilton, and Ingham University at Le Roy. None of these institutions reports advanced work, and they are therefore sufficiently described in the statistical tables.

St. Bonaventure's College, St. Francis College, St. John's College at Brooklyn, St. John's College at Fordham, St. Joseph's College, the College of St. Francis Xavier, Manhattan College, Elmira Female College, and Rutgers Female College failed to report. Such facts as may be given concerning these colleges have been gleaned from their catalogues.

WELLS COLLEGE, AT AURORA.

Edward L. French, professor of natural and physical science.

Physics.—Taught by lectures and recitations through one-half of the sophomore year. Text book, Deschanel.

Chemistry.—Required through the whole junior year. The first half is devoted to general inorganic chemistry and the second to organic chemistry and qualitative analysis. Text books, Barker for general work, with Appleton and Fresenius in analysis. The laboratory is equipped for both qualitative and quantitative work, and can accommodate twenty-five students. Laboratory practice is required at least five hours a week, and at certain seasons from one to three hours a day.

Both chemistry and physics have been taught in the college since it was founded in 1868. Laboratory teaching was not introduced until about four years ago. Extra laboratory work on the part of the students is encouraged.

BROOKLYN COLLEGIATE AND POLYTECHNIC INSTITUTE, AT BROOKLYN.

Physics.—Daily exercises in Peck's Ganot are required of all students for six months in the fourth "academic" grade. In the collegiate department all students in the "scientific" and "liberal" courses study Snell's Olmsted for an entire year. Later, the "scientific" students spend twenty weeks upon mechanics, using Bartlett's and Twisden's text books. One hour every day is devoted to these studies. Laboratory work in physics is not reported.

Chemistry.—This study extends through two and a half years of the collegiate course. The first year is devoted to daily exercises of an hour each upon general chemistry and chemical philosophy, and is required of all students in "scientific" and "liberal" courses. Text books, Youmans and Cooke. One-quarter of a year is given to blowpipe analysis, and five quarters to qualitative and quantitative work. The course includes assaying and the analysis of commercial products.

Chemistry and physics have both been taught at this institution since its opening in 1854. Chemical philosophy, analysis, and the higher portions of the course in physics were introduced in 1865.

HAMILTON COLLEGE, AT CLINTON.

Physics.—Professor, Chester Huntington, who is also librarian. Required for twenty-two weeks in the latter part of the junior year. Recitations from Atkinson's Ganot, with experiments and lectures. A fund of five hundred dollars furnishes two annual prizes for excellence in this department. Special and post graduate students may study advanced physics and have the use of laboratory and apparatus.

Chemistry.—Professor A. H. Chester. In the senior year there are fourteen weeks in general chemistry, with lectures. The text book is Eliot and Storer. In the latter part of the same year there are also seven weeks of lectures upon agricultural chemistry. This amount of chemistry is required of all students. For an elective study, the seniors may take nineteen weeks of laboratory practice, Eliot and Storer's Qualitative Analysis being used. Special students and post graduates may also be admitted to the laboratory.

The foregoing requirement in agricultural chemistry is made in accordance with the will of the late Silas D. Childs, who endowed the chair and did much for the laboratory, in which sixteen students can be accommodated. A fund of five hundred dollars yields two annual prizes for excellence in chemistry.

Both chemistry and physics were taught by one professor until 1870, when the chair was divided. Professor Chester reports original researches upon variscite, fibrous sepiolite, artificial gold crystals, Sconondoah spring water, the percentage of iron in United States ores, and a method for the determination of phosphoric acid.

CORNELL UNIVERSITY, AT ITHACA.

This university was first opened in the autumn of 1868. From that time both chemistry and physics have been taught in it.

Physics.—William A. Anthony, professor of physics and experimental mechanics; G. S. Moler, instructor. The latter assists the professor in preparing and performing lecture experiments, and also takes charge of half the sections into which the class is divided for recitations.

The general course in physics extends through two years, with exercises three times a week for four terms and twice a week in the other two. Students in technical courses and the general course in science take the whole. Other students are required to take but one of the two years, although they may choose the second as an elective. In the regular classical course, physics is altogether an optional study. The subjects are divided in time as follows:

Sophomore year.—First term, experimental mechanics; second and third terms, electricity and magnetism.

Junior year.—First term, heat; second and third terms, acoustics and optics.

The aim is to make the two years so entirely independent of each

other that a student may take the second without having studied the first.

Laboratory work is optional except in the courses of chemistry and physics and mechanical engineering. Some ten or twelve students usually elect laboratory practice in the senior year. The work is mostly of a quantitative nature, intended to give the student an idea of the methods employed and the care to be exercised in making physical measurements. Some post graduate work has been done. Probably the best original research thus far was upon the rate of nervous transmission.

The rooms available for physical manipulation are somewhat scattered, but good provision for such work has been made. The physical lecture and apparatus rooms may be used by students during afternoons for experimental practice. Several rooms in the south building have been fitted up for experimenting upon the mechanical powers, strength of materials, elasticity of gases, flow of gases and liquids, the solar spectrum, polarized light, and photometry. In the chemical laboratory building a room has been equipped for instruction in photography and for the making of photographic lantern slides for scientific illustration. Several thousands of these have already been prepared. The general outfit of physical apparatus is good, especially for electrical measurements. Among other things there is a telegraph line more than three miles long, upon which tests for insulation, resistance, and the location of faults may be made; and also a Gramme magneto-electric machine, constructed at the university workshop.

Chemistry.—C. A. Schaeffer, professor of general and analytical chemistry and mineralogy; G. C. Caldwell, professor of agricultural and analytical chemistry; C. H. Wing, non-resident professor of organic chemistry; A. A. Breneman, professor of industrial chemistry and assistant professor of analytical chemistry; W. H. Kent and M. M. Garver, instructors; William Keith, curator of laboratories. For the course in arts and course in literature, chemistry is an elective study; for the courses of science and letters, mathematics, architecture, and civil engineering, two terms of general chemistry, three times a week, are required. The courses in philosophy, science, and mechanic arts require two sophomore terms of chemistry, three times a week, and twice a week in the first junior term. The course in science also gives opportunities for six terms of elective chemical study. In the course in natural history the freshmen take two terms of general chemistry, three times a week, and the same number of laboratory exercises. The sophomores have organic chemistry, twice a week, for one term; and in the next term they take blowpipe analysis three times weekly. In the course in agriculture the freshmen have two terms of general chemistry; the sophomores study agricultural chemistry five hours a week for two terms, and qualitative analysis four times a week through the same in-

terval. For juniors there is quantitative analysis two terms, four to five exercises weekly.

There is a two years' course in chemistry and physiology, leading to no degree. The regular four years' course in chemistry and physics is as follows, the figures in parentheses indicating the number of hours a week the study is pursued:

First year.—First term: Algebra (5), French and German (8), rhetoric and composition (2), six lectures on hygiene. Second term: Solid geometry (5), French and German (8), rhetoric and composition (2). Third term: Trigonometry (5), French and German (8), rhetoric and composition (2).

Second year.—First term: Analytical geometry (5), French or German (3), experimental mechanics (3), physiology (3), chemical practice (2). Second term: Chemistry (3), electricity and magnetism (2), French or German (3), zoölogy (3), chemical practice (6). Third term: Chemistry (3), electricity and magnetism (2), French or German (3), botany (3), chemical practice (4).

Third year.—First term: Chemical philosophy (3), heat (2), geology (3), chemical practice (7). Second term: Chemical philosophy (3), mineralogy or metallurgy (2), organic chemistry (1), acoustics and optics (3), geology (3), chemical practice (5). Third year: Chemical philosophy (3), chemical technology (2), acoustics and optics (3), chemical practice (7).

Fourth year.—First term: History of philosophy (2), physical practice (4), chemical practice (10), organic chemistry (1). Second term: Metallurgy or mineralogy (2), organic chemistry (2), chemical practice (8), physical practice (4). Third term: Chemical technology (2), chemical processes (2), chemical practice (8), organic chemistry (1). Thesis.

In laboratory work, two and a half hours are counted equivalent to one hour of recitation or lecture.

Stated in still a different form, without reference to what is required in the several courses, the instruction in chemistry is as follows: *General chemistry:* Sixty lectures inorganic and twenty-four organic, covering three terms of work. The organic chemistry is elementary. *Laboratory practice:* This begins with a course of exercises in elementary chemical manipulation. As little assistance as possible is given the student, to whom is left the result of each experiment and its interpretation. A written report of all work is daily handed to the instructor for criticism. After the usual qualitative course, quantitative analysis is taken up. Work is here laid out with reference to the future needs of individual students, whenever it is possible to do so. Those who are preparing for some application of chemistry to industrial processes are directed as early as possible towards original investigation in the line of the industry specified. Instruction in blowpipe analysis, determinative mineralogy, and assaying is given in the appropriate rooms at all laboratory hours. *Industrial chemistry:* Two series of sixteen lectures each occupy the third terms of two successive years. A collection of raw

materials, waste, and finished products is being made to illustrate chemical industries and to exhibit before the class. The study of this material in detail is an essential feature of the course. Printed synopses of the lectures and copies of all diagrams used to illustrate them are given to each student who attends them. *Agricultural chemistry:* The course of instruction includes about sixty lectures and a large amount of laboratory practice. *Medical chemistry:* Students who intend to pursue the study of medicine receive a course of laboratory instruction in qualitative and quantitative analysis, the latter being especially in the line of the animal secretions. *Chemical philosophy:* Cooke's treatise is used as a text book, and special attention is paid to the problems contained in it. Lectures are also given upon recent developments of the subject, and the reading of Wurtz's History of Chemical Theory is required. *Higher organic chemistry:* Advanced instruction is given by lectures and recitations, the text book for the latter being either in French or in German. During the past year the second volume of Naquet's Principes de chimie has been used.

The laboratory rooms open to students are as follows: (1) the general laboratory for introductory and qualitative work; (2) a special laboratory for general quantitative analysis; (3) a special laboratory for agricultural and medical quantitative analysis; (4) a blowpipe room; (5) an assay room; (6) a room for spectroscopic and other optical work in chemistry; (7) a room for weighing and for the analysis of gases; and (8) a reading room. The last named room is well provided with chemical journals and works of reference.

All chemicals needed for experimental or analytical work are directly accessible to students. Gases are drawn from appropriate stop cocks in the general laboratory, at a table provided with pneumatic troughs. Hydrogen and sulphhydric acid are carried to the different rooms of the laboratory from generators in charge of the curator. Richards's jet aspirator is used for water blast and filter pumps, one of the latter being attached to every working table in the quantitative laboratories. These rooms are also fitted with steam evaporating baths, drying closets, self regulating air baths at different temperatures, batteries for electrolytic determinations, and so forth. The laboratories are open five days in the week from eight o'clock until five, and students are permitted to arrange their working hours according to their own convenience. But not less than two hours of continuous work can be taken at any time. Chemicals, apparatus, and gas are supplied to students at current prices.

A chemical and physical society has been organized by the special students in chemistry and physics, for the reading of original papers and the general discussion of appropriate subjects. It meets semimonthly in the laboratory building.

COLUMBIA COLLEGE, AT NEW YORK.

I.— *The School of Arts.*

Physics.— Professor Ogden N. Rood; M. C. Ihlseng, assistant. During the first half of the junior year, two hours a week are spent upon the subject of heat. In the second half, the same amount of time is devoted to specific heat, magnetism, and electricity. Mechanics is also taught in this term, partly from a text book and partly by lectures illustrated with working models; but the time allotted to it is not stated. In the senior class three hours a week are given to optics in the first term and to acoustics in the second. All this work is prescribed. Higher physics, as an elective study, is also taken by a limited section of the senior class, two hours a week, throughout the year. In this course, such subjects as electrostatics, the undulatory theory of light, polarization, the mechanical theory of heat, thermodynamics, &c., are discussed.

Two scholarships of $100 each are assigned, after a special examination, at the close of the junior year. One is for general physics, the other for mechanics.

The collection of physical apparatus is one of the finest in this country. A description of some of its more striking features is given in the Handbook of Information. No regular physical laboratory for student use is, however, reported.

Chemistry.— Professor C. F. Chandler; L. H. Laudy, assistant. The sophomore class attend one exercise a week in chemistry throughout the year. Instruction is given chiefly by lectures, with the aid of Roscoe as a text book. The students are expected to take notes and to pass monthly examinations on the subjects taught. The course includes the general principles of chemistry, a short account of each of the common elements, its occurrence in nature, chief compounds and uses, and so on. In addition to this a brief outline of vegetable and animal chemistry is presented.

General chemistry is also taught during the senior year, three times a week, as an elective, by lectures, with the aid of Fownes's text book. A full exposition is given of principles and details in both inorganic and organic chemistry. The lectures are illustrated by very full collections of chemical specimens, which are accessible to students for examination and study. No laboratory work is reported.

A scholarship of $100 is assigned, after a special examination, at the close of the sophomore year.

II.— *The School of Mines.*

This school was first opened in 1864, and in 1874 the present building, with its superb laboratories, was completed. Special students are admitted only by vote of the faculty. Those who take chemistry pay the fee for a full course of study, namely, $100. Special students in assaying, for a course of two months' instruction, pay $50.

There are five regular courses of study: (1) In mining engineering; (2) in civil engineering; (3) in metallurgy; (4) in geology and palæontology; (5) in analytical and applied chemistry. These courses all coincide in the first half of the first year.

Physics.—Professor, O. N. Rood; mechanics is taught by Professor William G. Peck. The first year students, in the first term, take up the subject of heat, including the steam engine, and acoustics. In the second term they study optics, electricity, and magnetism. The courses are illustrated by experiments and problems and are prescribed for all students. To the third year class, lectures are delivered upon electrostatics, the mechanical theory of heat, mathematical optics, and the undulatory theory of light. Some of the lectures are accompanied by experimental demonstrations. This course is required of all students except those in chemistry, with whom it is optional.

Mechanics is taught in the third year to the students in mining engineering, civil engineering, and metallurgy. The mechanics of solids is studied in the first term and the mechanics of fluids in the second.

No physical laboratory work is mentioned in the Handbook of Information.

Chemistry.—Professor, C. F. Chandler; instructors, Elwyn Waller, Pierre De Peyster Ricketts, Alexis A. Julien, James S. C. Wells, Henry C. Bowen, Francis N. Holbrook, and Louis H. Laudy. General inorganic chemistry, stoichiometry, qualitative analysis, quantitative analysis, and blowpiping are required studies in all the courses. Assaying is taught to students in mining, metallurgy, and chemistry. In the geological and chemical courses, organic chemistry is studied. The chemical students have also a large amount of work in applied chemistry. Quantitative blowpipe analysis is an optional study in all of the courses.

In general chemistry the first year students attend three exercises a week throughout the year. This course is preliminary to practical instruction in the laboratory. The students are drilled upon the lectures, with free use of the best text books, and take notes which must be submitted to the professor. At the end of the year there is a rigid examination. The second class also attend three times a week during the year, and receive instruction in theoretical chemistry adapted to the needs of special scientific students.

For analytical chemistry there are three laboratories, one for qualitative analysis, one for quantitative analysis, and a third for assaying. Each of these is thoroughly equipped and is in the special charge of an instructor with an assistant. Every student is provided with a convenient table containing drawers and cupboards, and is supplied with a complete outfit of apparatus and reagents. The laboratories are open daily, except Saturdays, Sundays, holidays, and vacations, from 10 A. M. to 4 P. M.

During the second year, qualitative analysis is taught by lectures, blackboard exercises, and constant laboratory practice. The spectroscope

is freely used. When the student shows, by written and experimental examination, that he is sufficiently familiar with qualitative work, he is allowed to enter the quantitative laboratory. In the third and fourth years, quantitative analysis is taught, the laboratory exercises being accompanied still by lectures and blackboard work. The laboratory course is graded after the usual manner, the student beginning with comparatively simple substances of known composition and passing on by degrees to the analysis of more complex bodies, such as coals, pig iron, various ores, slags, mattes, and so on. Both volumetric and gravimetric methods are employed. In the fourth year the student is admitted to the assay laboratory, where he is furnished with a suitable table and a set of assaying apparatus. Here he has access to crucible and muffle furnaces and to volumetric apparatus for the assay of alloys of gold and silver. The general principles and special methods of assaying are described in the lecture room and at the same time the ores of the various metals and their appropriate fluxes are exhibited and described. The student is then supplied with different ores and is required to assay each ore in duplicate under the supervision of the instructor.

Stoichiometry is taught, by lectures and blackboard exercises, as a part of the course in general chemistry, through the first and second years; and its practical applications are developed in lectures upon quantitative analysis and assaying.

In applied chemistry, the instruction extends through the third and fourth years and consists of lectures illustrated by experiments, diagrams, and specimens. The cabinet of industrial chemistry is very large and complete, containing several thousand specimens of materials and products.

The following is the regular course pursued by students in analytical and applied chemistry:

First year.—First term: Geometry, algebra, physics, inorganic chemistry, French, German, drawing. Second term: Algebra, conic sections, trigonometry, mensuration (optional), physics, organic chemistry, botany, French, German, drawing.

Second year.—First term: Inorganic chemistry, qualitative analysis, blowpipe analysis (qualitative), zoölogy, French, German, analytical geometry (optional). Second term: Qualitative analysis, crystallography, theoretical mineralogy, zoölogy, French, German, organic chemistry, calculus (optional).

Third year.—First term: Applied chemistry—chemical manufactures (embracing acids, alkalies, and salts), glass, porcelain, pottery, limes, mortars, and cements; quantitative analysis, stoichiometry; determinative mineralogy, geology (optional), metallurgy—fuels, furnaces, &c.; physics (optional). Second term: Applied chemistry, as in first term; quantitative analysis, stoichiometry, determinative mineralogy, quantitative blowpipe analysis (optional), historical geology (including palæontology, optional), metallurgy—iron and steel; physics (optional).

Fourth year.—No distinction of sessions. Applied chemistry; fuel and its applications; artificial illumination: candles, oil, lamps, petroleum, gas and its products; food and drink: water, milk, cereals, starch, bread, meats, tea, coffee, sugar, fermentation, wine, beer, spirits, vinegar, preservation of food, tobacco, &c.; clothing: textile fabrics, bleaching, dyeing, calico printing, paper, tannin, glue, India rubber, gutta percha, &c.; artificial fertilizers: guano, superphosphates, poudrettes, &c.; disinfectants: antiseptics, preservation of wood, &c.; assaying: ores of lead, silver, gold, platinum, tin, antimony, bismuth, copper, nickel, cobalt, iron, mercury, and zinc, gold, silver, and lead bullion, mattes, slags, &c.; metallurgy: copper, lead, silver, gold, zinc, tin, mercury, &c.; supplementary lectures on iron and steel; economic geology.

In addition to the foregoing work, students are required to prepare, in the long vacations between the first and second, second and third, and third and fourth school years, memoirs upon special chemical subjects. These are selected from lists of subjects indicated by the faculty. Also, before graduation, a chemical dissertation is required upon a topic selected by the student, subject to the approval of the president and the professor of chemistry.

It will be seen that this course of study is almost exclusively technical in its tendencies. It is designed to train analysts and technologists, rather than purely scientific investigators. A considerable amount of original research work has, however, been done by the graduates of the course, and a small pamphlet catalogue of their publications has been prepared by Mr. Marcus Benjamin, of the class of 1878. The course was established in 1868, and at the date of writing twenty-six students have graduated in it.

COLLEGE OF THE CITY OF NEW YORK.

Physics.—In the introductory or subfreshman year, experimental lectures upon heat, light, and electricity are delivered by the professor of chemistry. In the junior year, mathematical physics is taught by the professor of applied mathematics. The classical students have three lessons a week; mechanics and acoustics occupy the first term, and optics and astronomy the second. In the scientific course, acoustics is taken twice a week in the first junior term, and optics in the second, with five lessons a week upon analytical mechanics in the earlier half of the senior year. Instruction is partly by lectures and partly by blackboard work. Text books, Bartlett's Acoustics and Optics, and Analytical Mechanics.

There is a small laboratory, in which post graduate students may study experimental physics.

Chemistry.—Lectures upon inorganic, organic, and applied chemistry in the subfreshman year. In the department of natural history, all students of the junior class are taught blowpipe analysis as applied to mineralogy. This course extends through sixteen weeks, with two les-

sons weekly. There is a small chemical laboratory, in which post graduate students may take up qualitative analysis.

A considerable amount of original work is reported as having been done by teachers in this college. The list, which is too long to republish, contains the names of Profs. Wolcott Gibbs, R. Ogden Doremus, John Christopher Draper, Alfred G. Compton, and A. W. Wilkinson; and gives the titles of some researches of great celebrity.

UNIVERSITY OF THE CITY OF NEW YORK.

Physics.—George W. Coakley, professor of mathematics, natural philosophy, and astronomy. The study is prescribed for two-thirds of the junior year. Text book, Loomis.

Chemistry.—John W. Draper, professor of chemistry and natural history; Henry Draper, adjunct. In the department of arts, chemistry is taught through two sophomore terms. In the three years' course of study in the department of science, chemistry is studied throughout the first year and analytical chemistry occupies two terms of the third year. The same amount of chemistry is taught in the course in civil engineering.

The laboratory is equipped for the teaching of both qualitative and quantitative analysis and "the principles of chemical research as applied to agriculture, the manufacturing arts, photography, assaying, the use of the microscope, and the physiological examination of the various animal products and secretions."

VASSAR COLLEGE, AT POUGHKEEPSIE.

Physics.—Professor, Le Roy C. Cooley. The course extends through the junior year, with daily lectures and recitations. The lectures are illustrated by experiments and accompanied by references to standard works in the college library. In the recitations the students discuss each subject in the light of the lecture, the experiments, and the references. The application of mathematics is required throughout the course. Mechanics, including the discussion of matter and force, motion and energy, and the phenomena of liquids and gases, and electricity, are studied in the first half of the year. In the second half there is a thorough discussion of vibrations, followed by the study of sound, light, and heat.

Chemistry.—Professor Cooley. This study occupies the latter half of the sophomore year and the first half of the senior. The method of instruction is much the same as in physics. The sophomores study descriptive and theoretical chemistry, with laboratory practice. The seniors pursue a course of analytical and applied chemistry, using as a text book for the former Eliot and Storer's Qualitative Analysis. Simultaneously there are lectures given upon carbon compounds, various manufactures, destructive distillation, coal tar, aniline, the galvanic battery, electrolysis and electrometallurgy, and the spectroscope and photography.

Neither chemistry nor physics is an absolutely obligatory study. Each is one of five or six branches laid down for the semester, and of which the student must elect three. A pupil may escape them; but this rarely happens. There is at present a laboratory available for qualitative analysis. A separate laboratory building is, however, now building, and it will be finished before this report is in print. Then the facilities for these studies will be largely increased and fuller work will be done. In the new building there will be a chemical laboratory, with seventy desks; a physical laboratory and cabinet twenty-four by forty feet; a room for metallurgy; a room for spectroscopy and other optical uses; a professor's laboratory; a chemical museum, and other apartments of less prominence.

Professor Cooley reports researches as follows: "On the theory of the convection thermoscope," Journ. Frank. Inst., 1875; "On repulsion by radiation at atmospheric pressure," Proc. Poughkeepsie Soc. Nat. Sci., 1875; "On the convection thermoscope for projection," Journ. Frank. Inst., 1877; "On the electric register and König's tuning forks," Journ. Frank. Inst., 1877.

UNIVERSITY OF ROCHESTER.

Physics.—Taught through two junior terms of thirteen weeks each. Required for one term. The instruction is given by daily recitations, with experiments and lectures. Text book, Snell's Olmsted.

Chemistry.—Professor, S. A. Lattimore. One junior term of daily recitations, with experiments and lectures. Text book, Roscoe. Following this there is an optional course in laboratory practice, including qualitative analysis. Text books, Prescott and Douglas, Fresenius's Qualitative Analysis, and Attfield's Pharmaceutical Chemistry. The laboratory has accommodations for twenty-eight students.

UNION COLLEGE, AT SCHENECTADY.

Physics.—Taught chiefly by recitations and lectures. In the classical course it is studied through the junior year and for one senior term. In the scientific course it extends through the junior year and is elective in all three of the senior terms. Engineering students have two years in physics. In the physical room there are desks for about ten students.

Chemistry.—Professor, Maurice Perkins. Studied in the classical course for one sophomore term. In the scientific course two junior terms are given to the subject, in addition to the foregoing, and one term of the senior year contains chemical analysis. The engineering students give two terms to chemistry and are required to do laboratory work.

The chemical laboratory has desks for twenty-five students and affords facilities for the study of general chemistry, applied chemistry, and qualitative and quantitative analysis. For the full special course in chemistry a fee of $35 a term is charged; for a half day course, $25;

and for two hours a day, $10. A deposit is also required to cover the cost of materials used. A few original researches are reported, but the full titles are not given. There was a professor of natural philosophy here as early as 1797. From 1811 to 1819 J. C. Bunnell was professor of both chemistry and physics. In 1820 the chair was divided.

SYRACUSE UNIVERSITY, AT SYRACUSE.

Rev. John J. Brown, A. M., professor of chemistry and physics.

Physics.— Candidates for admission to the college of liberal arts are obliged to pass an examination based upon Steele's text book. Instruction, compulsory upon all regular students, is given by lectures and recitations through two-thirds of the sophomore year. The first term is devoted to the laws of solids, liquids, and gases; the second, to heat, light, and electricity. Text books, Atkinson's Ganot and (in part) Deschanel. Peck's Mechanics and Bartlett's Acoustics and Optics are used in connection with the mathematical studies. Mechanics, required in the "scientific course" but optional in all other courses, occupies five hours a week through one junior term. Acoustics and optics, to which the same rule of election applies, are also taught to the juniors, but the time alloted to them is not specified in the university catalogue. No laboratory work in physics is reported.

Chemistry.— Required through two junior terms in all of the courses and taught chiefly by experimental lectures. In the first term the history of chemistry and chemical philosophy are considered, with two exercises weekly. In the second term, four times a week, the non-metallic and metallic elements are studied. Text books, Barker and Fownes. Some laboratory work is required in the scientific course. Analytical chemistry, from two to three exercises a week, is optional in all courses. The laboratory gives opportunity for twelve students to work at a time, and can be enlarged to accommodate fifty. No research work is reported.

RENSSELAER POLYTECHNIC INSTITUTE, AT TROY.

In this institution there is now but one course of study, and the only degree conferred is that of civil engineer. The work done in chemistry and physics, therefore, has special reference to the needs of the engineering profession.

Physics.— Assistant Professor A. W. Bower. In the first year, Atkinson's Ganot is studied as far as acoustics, and in the second year heat, sound, and light are taken up. Electricity and magnetism are studied by the third year class, upon the basis of Jenkin's work. The seniors have also a course in thermodynamics, using Rankine on the steam engine and omitting the descriptive portion. To a great extent the course is one of class drill, although every exercise is supplemented by additional matter. A large number of practical examples are given out for blackboard work. The apparatus is limited, so that no physical

aboratory practice can be assigned; but one or two experimental lectures a week are delivered.

Chemistry.—H. B. Nason, professor of chemistry and natural science W. P. Mason, assistant. Inorganic chemistry is studied by the second year class. In the third year, instruction is given in qualitative and blowpipe analysis, determinative mineralogy, and technical chemistry. Metallurgy is taught during the fourth year of the course.

The Winslow Laboratory is a three story building, 60 feet by 40. In the first story is the metallurgical laboratory. The second and third stories contain the chemical laboratory and lecture room, both of which are fitted up in the most approved manner. There is a large cabinet of chemical specimens; also, a good metallurgical collection.

UNITED STATES MILITARY ACADEMY, AT WEST POINT.

Physics.—P. S. Michie, professor of natural and experimental philosophy. The study is wholly prescribed, and is taken during the third year of the course. Analytical mechanics, the mechanics of molecules, acoustics, and optics are studied mainly from Bartlett's text books. There is good apparatus, with laboratory facilities for instructors, though not for students.

Chemistry.—H. S. Kendrick, professor of chemistry, mineralogy, and geology. Taught in the third year. The course includes chemical physics, heat, electricity, &c., and theoretical, inorganic, and organic chemistry. Text book, Fownes, with intercalated matter. No laboratory work is done by students.

NEW JERSEY.

From St. Benedict's College, Seton Hall College, and the College of New Jersey, Princeton, no reports were received. The information given concerning these colleges has been drawn from their catalogues, except that the historical portions relative to Princeton have been collected from various sources.

STEVENS INSTITUTE OF TECHNOLOGY, AT HOBOKEN.

Elementary physics and chemistry are both taught in the Stevens High School, which prepares pupils for the Institute. A knowledge of these subjects is not, however, required for admission to the latter.

Physics.—Professor A. M. Mayer. A four years' course of instruction is provided and facilities are extended to post graduate students for advanced and special study and research.

In the first year the inductive method of research, the general properties of matter, inductive mechanics, pneumatics, the laws of vibratory motion, acoustics, and heat are studied. The second year is devoted to the laws of heat in their application to heat engines, meteorology, ight, magnetism, and electricity. During the third year the professor

lectures upon the modes of making exact measures. He shows the application of these measures in the various departments of science and explains the construction, methods of adjustment, and manner of using instruments in precise measurements. The fourth year the student spends in the physical laboratories, pursuing experimental investigations, schedules of which are prepared for him by the professor. The degree of doctor of philosophy is given only after the laboratory work of the student has been approved by the professor of physics and a thesis covering an original investigation has been laid before the faculty.

The collection of physical apparatus is one of the most extensive in America, and is peculiarly fitted for the higher work of research. In the annual announcement of the institute it is elaborately described, with numerous illustrations. Since the institute was opened, in 1871, a considerable number of investigations in physics have been published by Professor Mayer, President Henry Morton, Professor Thurston, and their associates. A list of these memoirs is given in the annual announcement.

Chemistry.—Professor A. R. Leeds. The study is begun in the second year of the institute courses, and may continue for three years. After that there are still opportunities for post graduate work.

The first year in chemistry is entirely occupied with the philosophy of the subject. All the allotted time is given to lectures upon the laws of combination, units of weight, heat, force, &c.; relations of volume; the effects of physical energy in the production of chemical change; the doctrines of quantivalence, and so on. The lecture illustrations are made as pertinent as possible to this work, which Professor Leeds considers to be the most important part of the course. The second year is taken up with qualitative and blowpipe analysis, mineralogy being touched upon only in an incidental manner. The elements are considered separately and in groups, as usual; but each student is obliged to show the professor the result of every operation performed. When the pupil understands the reason for every reaction which he has applied with known substances, the study of analysis proper is begun. The presentation of written notes is not, however, taken as evidence of accurate work; the results themselves must be shown to the professor before they are permitted to be destroyed. The third year is devoted to quantitative analysis, an effort being made to illustrate the most important classes of volumetric and gravimetric methods, and examples being taken from technical products, ores, minerals, &c. The satisfactory accomplishment of these tasks, showing that the student is capable of accurately performing whatever work would ordinarily come into the hands of an analytical chemist, entitles him to the degree of bachelor of philosophy, provided at the same time that he has mastered the use of instruments of precision in the physical laboratory. After this, the few advanced students who remain in the institute devote their time to methods of research, to be terminated by the discovery of some new

body or by the more precise knowledge of the properties of substances already known. Success in this direction is rewarded with the degree of doctor of philosophy. As yet but one such degree has been conferred. A prize in chemistry, known as the Priestley prize and amounting to $25, is annually awarded for superior excellence in this department.

The chemical laboratories are thoroughly fitted up. In connection with the department there are also collections of minerals, chemicals, and technical products. The annual announcement contains a summary of these collections, plans of the laboratory and other rooms, and a list of the original researches which Professor Leeds has published from the institution.

RUTGERS COLLEGE AND NEW JERSEY STATE AGRICULTURAL COLLEGE, AT NEW BRUNSWICK.

Physics.— G. B. Merriman, professor of natural philosophy and astronomy. This study is taken through two-thirds of the junior year. The text book is Deschanel and there is good apparatus for experimental illustrations. In the classical department there is a junior elective of one term in analytical mechanics. Students in engineering have mechanics for two senior terms.

Chemistry.— George H. Cook, professor of chemistry, natural history, and agriculture; F. C. Van Dyck, professor of analytical chemistry; P. T. Austen, assistant professor of chemistry. In the classical department there are lectures on inorganic chemistry throughout the junior year. The senior class have organic chemistry for one term and chemical physics for another. In addition to this prescribed work, analytical chemistry is laid down as an elective study through the junior and senior years.

In the scientific department there are two regular courses of study, extending through four year's, one in civil engineering and mechanics, the other in chemistry and agriculture. There is also a special course of two years in chemistry, with opportunity for post graduate work. Through the sophomore year, students in both of the regular courses attend lectures upon theoretical and inorganic chemistry, using Barker's text book. The seniors in the engineering course also hear one term of lectures upon organic chemistry and one term upon chemical physics. For the students in chemistry and agriculture, chemical instruction is given both in the junior and in the senior years. The juniors have determinative mineralogy and analytical chemistry, while the seniors continue their laboratory practice and hear lectures upon agricultural chemistry and chemical physics. According to the catalogue, the laboratory work of the last senior term seems to be devoted to a thesis. The special course in chemistry is as follows:

First year.— First term: Elements of chemistry (text book and lectures), blowpipe analysis, elements of mineralogy. Second term: Phys-

ics and chemistry (text book and lectures), qualitative analysis. Third term: Qualitative analysis and mineralogy.

Second year.— First term: Analysis of minerals, ores, &c., determinative mineralogy. Second term: Chemical physics (text book and lectures), analysis of fertilizers and chemical products. Third term: Lectures on geology, chemical analysis, special investigations.

In all the lecture courses the students are required to take notes and to submit them to the inspection of the professor. Problems are given out for solution continually. In the laboratory a written report of every analysis is required. Rigid written and oral examinations are held at the end of every term. Original research on the part of advanced students is encouraged to the utmost. Post graduate students are taken in as subassistants and receive a certain compensation for their work; they thus acquire that most valuable discipline which teaching alone can give.

The laboratory accommodations are excellent. The blowpipe room is fitted up for eighteen students, and in the qualitative and quantitative laboratories there are thirty-five desks of the most approved pattern. Each desk has four drawers and a large cupboard, two gas jets and a gas light above. Apparatus is furnished to students in blowpiping and analytical chemistry and charged to them in an account book. At the end of the year this apparatus, if in good order, is taken back at 90 per cent. of its appraised value. A charge of $15 a term is made for chemicals and gas.

Professor Cook has published many investigations upon ores, clays, marls, soils, waters, &c., in the geological reports of New Jersey; also, analyses of many fertilizers in the annual reports of the Agricultural College. Professor Austen submits a long list of original researches, the greater number of which, however, were published before he became connected with this institution.

COLLEGE OF NEW JERSEY, AT PRINCETON.

Physics.—Professor C. F. Brackett. Required in the classical course throughout the junior year and during the second and third senior terms. Laboratory practice is elective for the seniors. In the school of science there is the same junior requirement, and, in addition, two senior terms of laboratory work. Post graduate courses are also offered.

Chemistry.— J. S. Schanck, professor of chemistry; H. B. Cornwall, professor of analytical chemistry and mineralogy; also, an assistant. Required in the classical course throughout the senior year. Applied and organic chemistry are put down for the same year as electives. In the school of science the following work is prescribed: For the second and third freshman terms, blowpipe analysis. Throughout the sophomore year, general inorganic chemistry, with qualitative analysis during the second and third terms. The juniors have quantitative analysis, and

the seniors take up volumetric work, assaying, applied chemistry, and organic chemistry. A deposit is required from each laboratory student to cover the cost of materials used and apparatus broken, the amount varying from eight to twenty dollars. For special courses in analytical chemistry the fee is $120 a year. Post graduate courses are offered.

Although lectures on chemistry were given in connection with physics at several colleges earlier than at Princeton, this institution was the first of its class in America to appoint a regular professor of the science in question. On the 1st of October, 1795, Dr. John Maclean, a young chemist of Scotland, was appointed professor. He remained until 1812; and it was in his laboratory that the elder Professor Silliman first became acquainted with experimental chemistry.

In physics, Princeton won distinction from the researches of Joseph Henry, who was professor here prior to the organization of the Smithsonian Institution.

PENNSYLVANIA.

In addition to the institutions described in the text, reports were received from the University at Lewisburg, Mercersburg College, Westminster College, La Salle College, the Augustinian College of St. Thomas of Villanova, and Waynesburg College. Data concerning these colleges are given in the statistical tables.

Muhlenberg College, Lebanon Valley College, Ursinus College, Pennsylvania College, Thiel College, Monongahela College, St. Vincent's College, St. Francis College, Allegheny College, Palatinate College, New Castle College, St. Joseph's College, and Swarthmore College did not report. Such facts as are given concerning them have been gleaned from their catalogues.

DICKINSON COLLEGE, AT CARLISLE.

Charles F. Himes, professor of natural science.

Physics.—Three recitations a week from Atkinson's Ganot through one junior and two senior terms; in all, equivalent to a full college year. There is a good outfit of physical apparatus, which the students themselves handle to a certain extent in a special experimental course of study.

Chemistry.—Through two-thirds of the junior year there are two lectures and three recitations a week. There is also a course of elementary introductory lectures towards the close of the sophomore year. Text book, Roscoe. In the scientific elective course, practical studies in science may be substituted for the Greek of the junior year and for the Latin and Greek of the senior class. In the Latin-scientific course, also, students are required to do laboratory work. The amount of time assigned to practice is at least one afternoon a week, with larger privileges to such students as manifest the ability and the inclination to improve them.

Work in the laboratory begins with experiments in elementary manipulation of the usual kind. Qualitative analysis, on the basis of Will's Tables, is next taken up. Opportunity is also given for the study of quantitative analysis, both gravimetric and volumetric, urinary analysis, toxicology, the testing of drugs, and practical photographic chemistry.

Members of the senior class in the elective course are required, as a part of their regular work, to deliver experimental lectures upon the subjects with which they are engaged before a scientific society, which is organized among the students of this department. A prize, called the Scientific Society's prize, is awarded to the senior who may give the fullest and best account of experiments made upon some subject selected by the society and approved by the professor.

There is also, in Dickinson College, a teachers' course, embracing instruction in the use and care of physical and chemical instruments, and the performance, *by means of the simplest and least expensive apparatus*, of the experiments adapted to the teaching of classes.

In the early history of American science Dickinson College occupies a conspicuous position. At the foundation of the institution in 1783, provision was made for natural philosophy, and liberal supplies of apparatus were obtained through Dr. Rush, of Philadelphia. In 1808 he writes that he has purchased for the college "an electrical and galvanic apparatus," and he describes it as being "the most complete and splendid thing of the kind ever imported into our country." In 1811 chemistry was first distinctly recognized, and a chair was established, to which Thomas Cooper was elected. Under Dr. Cooper, students were attracted to the college for the study of technical chemistry. In 1865, under Professor Himes, the laboratory electives in chemistry and physics, replacing some Latin and Greek, were introduced. In this new departure, which so many colleges have since taken, Dickinson College was one of the pioneers.

PENNSYLVANIA MILITARY ACADEMY, AT CHESTER.

Physics.—Taught in the freshman year, by recitations and illustrative lectures. Text book, Peck's Ganot.

Chemistry.—The sophomores recite from Barker's College Chemistry and attend experimental lectures. A laboratory is provided, in which every student has a separate work table. In this laboratory qualitative analysis and blowpiping are taught, and there are facilities for quantitative work and for assaying. Instruction of this character has been given for about ten years.

LAFAYETTE COLLEGE, AT EASTON.

Physics.—Professor, James W. Moore. A knowledge of the elementary principles of natural philosophy is required for admission to the general scientific course and to the several technical courses. The physics

required of all regular students in the college extends through the junior year, with four lectures a week in the first and second terms and five a week in the third term. The first term is devoted to mechanics; the second, to electricity, magnetism, and heat; and the third, to sound and light. In the first junior term the classical students may, if they choose, take mathematical mechanics in place of Greek. Analytical and applied mechanics (Rankine) are taught to the juniors in the engineering courses. At the date of reporting, laboratory work had not been introduced, but was soon to be. The physical department occupies Jenks Hall, a T-shaped limestone building, two stories high with a mansard roof, sixty-four feet front and seventy-five deep. The first floor contains a recitation room and small laboratories for sections. On the second floor is a lecture room thirty-five feet by seventy, apparatus rooms, and the professor's study. The third floor is occupied by the rooms of the Society of Physics and Engineering, a microscope room, photometric room, and the general physical laboratory; the latter can easily accommodate twenty-five students. There are also, on the first floor, a storeroom and an instrument shop. The outfit of apparatus is large and valuable.

Chemistry.—Traill Green, professor of general chemistry; F. C. Blake, adjunct; T. M. Drown, professor of analytical chemistry; Edward Hart, adjunct. The classical students are required to take general chemistry, with laboratory practice, in the third junior term, and are offered, in addition, chemical electives through two terms of the senior year. The instruction is by text book and lectures. In the general scientific course, general chemistry occupies the first freshman term, and, with laboratory practice, the second also. Analytical chemistry is taken in the third term and is optional throughout the sophomore year. There are chemical electives in the first junior term and the second and third senior terms. For the course in engineering, civil, topographical, and mechanical, the same freshman work in chemistry is prescribed, with one sophomore term optional, and a term of blowpipe analysis in the junior year. The same freshman and sophomore work is also given in the course of mining engineering and metallurgy. In this course analytical chemistry is also required through the junior and senior years, and assaying is prescribed for the second junior term. The regular chemical course is as follows:

Freshman year.—First term: Chemistry, English, French, algebra completed, elements of industrial drawing. Second term: Chemistry (with laboratory practice), French, German, geometry completed, drawing (plane problems). Third term: Analytical chemistry, French, German, elementary projections, trigonometry, and mensuration.

Sophomore year.—First term: Analytical chemistry, French, German, elementary projections, mineralogy, English (Trench on Words). Second term: Analytical chemistry, botany, zoölogy, mineralogy, French,

German. Third term: Analytical chemistry, botany, zoölogy, determinative mineralogy, French, German.

Junior year.—First term: Analytical chemistry, blowpipe practice, lithology, French. Second term: Analytical chemistry, assaying, physics, German, practice in lithology. Third term: Analytical chemistry, physics, French, or German.

Senior year.—First term: Analytical chemistry, chemical technology, physiological chemistry, metallurgy, toxicology. Second term: Analytical chemistry, chemical technology, agricultural chemistry, mineralogy, metallurgy, geology, political economy. Third term: Analytical chemistry, metallurgy, gas analysis, geology, history, graduation theses.

Throughout the year, themes, speaking, written debates, and biblical studies. Text books in chemistry in the German language are used during the junior and senior years.

The study of general chemistry at this college begins with a course of lectures, combined with text book work and laboratory exercises. After this, analytical chemistry extends through the course. Whether or not modern organic chemistry is taught, the college catalogue does not say. There are several post graduate chemical students and special students are admitted.

The laboratory rooms are as follows: A qualitative laboratory, a quantitative laboratory, two supplementary laboratories for advanced students and for research, rooms for gas analysis, assaying, and blowpipe work. These laboratories will accommodate fully a hundred students. There is also a large general laboratory with room for a hundred more, used by beginners or those taking a short course in qualitative analysis.

The study of natural philosophy began at the opening of the college in 1832. Chemistry was made a regular study in 1837, although there were irregular courses before that time. The chair of physics was separated from those of chemistry and mathematics in 1869. Pardee Hall, one story of which is occupied by the chemical laboratories, was completed in 1873, and in 1874 Dr. Drown was appointed professor of analytical chemistry. In 1875 the Lafayette Chemical Society was organized among the students and instructors. This society holds regular weekly meetings for papers and discussions and does much towards supplementing the work of instruction.

HAVERFORD COLLEGE, IN MONTGOMERY COUNTY.

Physics.—Professor R. B. Warder. The freshmen of the scientific course and the sophomores of the classical course take, for the first half year, three lessons a week in Norton's Natural Philosophy. The junior scientific students also have prescribed exercises twice a week, based upon Deschanel's text book. This latter course is an elective for the classical seniors. In physical laboratory practice there is an elective of two exercises a week in the scientific senior year. For this work the first volume of Pickering's Physical Manipulations is used to some

extent as a guide, although original problems outside of this are assigned by the professor for experimental investigation. The senior students also assist in the preparation of lecture experiments.

After 1879 candidates for admission to the scientific course will be examined in Stewart's Primer of Physics.

Chemistry.—Professor Warder. The freshman scientifics and the classical sophomores have in the second half year three lessons a week from Nichols's version of Eliot and Storer's Manual. In the sophomore year, first half, the scientific students have two exercises weekly in qualitative analysis, with Eliot and Storer's text book. Lectures are occasionally given on the subject and written reports of work are required. This course is an elective for the classical juniors. For the scientific juniors an elective is laid down in qualitative and quantitative analysis, twice a week, for half the year. Quantitative work is also an elective in the senior scientific class, but has at the date of writing no students taking it. A laboratory is reported, well fitted for analytical work and general chemistry. It is provided with water, gas, filter pumps, &c. There is a separate balance room.

UNIVERSITY OF PENNSYLVANIA, AT PHILADELPHIA.

Physics.—Professor, George F. Barker, and assistant, Arthur F. Taylor. In the department of arts, the study of physics is required during the junior year. Ganot is used as the text book, and there are also lectures.

In the Towne Scientific School three years' instruction in physics is given to all regular students. In the sophomore year there are recitations, with experiments and occasional lectures upon elementary mechanics, sound, and heat. To the juniors, light and electricity are taught by lectures, with occasional recitations and examinations. The seniors have astronomical and terrestrial physics and practice in the physical laboratory. Seniors taking the course in dynamical engineering also receive instruction in thermodynamics. Post graduate students in physics, who are candidates for the master of science degree, are required to undertake special research work and to present a satisfactory thesis.

The collection of physical apparatus is very valuable, and the laboratories and lecture room of the department are unusually well appointed.

Chemistry.—Frederick A. Genth, professor of chemistry and mineralogy; George A. König, assistant professor of chemistry, instructor in metallurgy and technical chemistry; Samuel P. Sadtler, assistant professor of chemistry, instructor in general and organic chemistry. Edgar F. Smith, assistant in analytical chemistry.

In the department of arts the sophomores have chemistry three times a week and hear during the year a course of lectures covering in a general way the whole field of the science, inorganic and organic.

In the Towne Scientific School there are provided six courses of study,

which diverge at the beginning of the third year. The freshmen have a course of fully illustrated experimental lectures upon inorganic chemistry twice a week throughout the year. In the sophomore class one term is devoted to recitations upon theoretical chemistry, a second to the outlines of organic chemistry, and the third to laboratory exercises in chemical manipulation. The text book for recitation work is Greene's translation of Wurtz's Elements of Chemistry, and there are three exercises weekly. At the beginning of the junior year the class divides into six sections. All begin the study of analytical chemistry at this point, but devote very different amounts of time to the work. In the two engineering courses qualitative analysis, metallurgy, determinative mineralogy, and blowpiping are studied. Students in the course preparatory to medical studies have qualitative analysis, organic chemistry, and determinative mineralogy through the junior year; and in the senior class they take up quantitative work, toxicology, and physiological chemistry. For the "chemical section" the whole course of study from the beginning is as follows, the same amount of chemistry in the junior and senior years being taken also by the section in geology and mining:

Freshman year.—History, English composition, French, algebra, geometry, trigonometry, drawing, German, chemistry.

Sophomore year.—English, German, French, spherical trigonometry, descriptive geometry, differential calculus, drawing, physics, chemistry, geology.

Junior year.—Physics, logic, geology, English, organic chemistry, chemical manipulations, qualitative and blowpipe analysis, chemical preparations, introduction to quantitative analysis, descriptive mineralogy, metallurgy, assaying.

Senior year.—History, English literature, international law, Thompson's Social Science and National Economy, compositions, declamations, quantitative analysis (gravimetric and volumetric), gas analysis (including the construction of eudiometers), organic analysis, water analysis, detection of impurities in food and drink, quantitative blowpiping, chemical preparations, metallurgy, determination of minerals by their physical properties, practice in agricultural chemistry.

A post graduate course of study has been arranged, but as yet no regular classes have been organized. Individual post graduate students have however been in attendance for several years past, working upon gas analysis, mineral analysis, organic research, and other special subjects.

The laboratories are exceptionally fine and fully equipped for all fields of chemical instruction. There is also a chemical museum. Since 1872 about twenty-five original investigations have been published by Professors Genth, König, Sadtler, and Smith in various scientific journals.

Chemistry and natural philosophy have been taught in a limited way in this university for nearly a hundred and twenty years. The present

system of teaching these sciences was established in 1872. A scientific society has been organized among the students, and meetings are held every week for essays and discussions.

WESTERN UNIVERSITY OF PENNSYLVANIA, AT PITTSBURGH.

Physics.—P. B. de Schweinitz, instructor in mechanical engineering, physics, and astronomy. In the preparatory department elementary physics is an optional study for one term of ten weeks, and the course is experimentally illustrated. In the university courses two terms, or half a year, are prescribed. Atkinson's Ganot is the text book, and the daily recitations are accompanied by experiments. This work is done in the junior year of the classical course and in the second or sophomore year of the scientific and engineering courses. There is as yet no physical laboratory for students.

Chemistry.—Francis C. Phillips, professor of chemistry, mineralogy, and geology. Lectures and recitations in general chemistry take place daily for twenty weeks, with Roscoe as the text book. This work is obligatory for the seniors in the classical course and for the juniors in the scientific and engineering courses. In the classical course the seniors have also one term of ten weeks in laboratory practice, three terms being prescribed in the other courses. In the laboratory both qualitative and quantitative analysis, blowpiping, and determinative mineralogy are taught. There are laboratory tables for ten students working simultaneously. At the date of reporting there were three post graduate students in analytical chemistry.

LEHIGH UNIVERSITY, AT SOUTH BETHLEHEM.

Physics.—Professor, H. W. Harding. In the classical and scientific courses the study of physics extends through three half years, being based upon Deschanel's treatise, with lectures and laboratory practice. In the first junior term, twice a week, the portions of the text book relative to mechanics are studied. In the second term, five times a week, galvanism, acoustics, and light are taken up. In the first half of the senior year, three times weekly, heat, meteorology, the barometric measurement of heights, magnetism, and statical electricity are discussed.

In the technical courses the same amount of physics is studied in the first freshman and both sophomore terms. Later, in the several engineering courses, instruction is given in applied mechanics. Students in mechanical engineering also devote two hours a week through the first senior term to thermodynamics. Work in the physical laboratory is a part of the prescribed course. Three hours of laboratory practice are reckoned equivalent to one hour of attendance in the lecture or recitation room.

Chemistry.—Professor, W. H. Chandler; instructor, E. H. S. Bailey. Professor Chandler is also director of the University Library. Two terms of instruction in chemistry are common to all the courses. The

classical and general scientific students have lectures and recitations based upon Fownes's text book three times a week in the second junior term. Through the second half of the senior year there are lectures and laboratory practice in qualitative analysis, three times weekly in the classical course and five times a week in the scientific course. In the technical courses the same work is done during the second freshman and first sophomore terms. Over and above the foregoing, chemical instruction is given in the several technical courses as follows:

Course in mechanical engineering: Blowpipe analysis, lectures, and laboratory practice once a week for one term.

Course in mining and metallurgy of four and a half years: Blowpipe analysis once a week for two terms; Cooke's Chemical Philosophy four and three times a week for two terms, respectively; quantitative analysis two, three, and seven times weekly for three terms; assaying once a week in the second senior term.

Course in metallurgy: Blowpipe analysis and chemical philosophy as in the previous course; assaying in the second sophomore term; quantitative analysis three times a week for one term.

In all of these courses metallurgy and determinative mineralogy, which are partly chemical studies, play important parts.

There is a special course of study leading to the degree of analytical chemist, as follows:

Freshman class.—First term: Geometry, completed (4), physics (2), French (3), German (4), drawing (2), essays and declamations (1). Second term: Algebra (5), chemistry (3), French (3), German (2), drawing (2), essays and declamations (1).

Sophomore class.—First term: Trigonometry, mensuration, and geometry (4), chemistry, qualitative analysis (5), physics (3), French or German (3). Second term: Calculus (4), descriptive geometry (3), physics (5), assaying (1), essays and original orations (1), blowpipe analysis (1), chemical preparations (1).

Junior class.—First term: Chemical philosophy (4), toxicology (1), quantitative analysis (7), crystallography (2), anatomy and physiology (1). Second term: Chemical philosophy (4), quantitative analysis (5), metallurgy (3), mineralogy (3).

Senior class.—First term: Organic chemistry (4), quantitative analysis (5), descriptive astronomy (3), psychology (1), English literature and history (2). Second term: Applied chemistry (3), medical chemistry (1), agricultural chemistry (1), geology (2), psychology and Christian evidences (2), preparation of theses.

The figures in parenthesis indicate the number of hours weekly assigned to each subject. The expense for chemicals and apparatus averages for each student under sixty dollars a year. Special students are received.

The laboratory is well equipped, and there is a good collection of chemical specimens. There is also among the students and instructors an organization known as the Chemical and Natural History Society of

the Lehigh University. This society has maintained several courses of public scientific lectures. Several original investigations in applied chemistry and mineral chemistry are reported.

PENNSYLVANIA STATE COLLEGE, AT GETTYSBURG.

Alfred Smith, professor of chemistry and physics.

Physics.—Taught from Deschanel's treatise, with accompaniment of the usual lecture room experiments. In the classical course the study is begun with the second junior term and continued to the end of the second term of the senior year. In the scientific and agricultural courses, the beginning is made at the same time, but the study is continued until graduation. It is the intention of the trustees soon to establish a separate chair of physics and to introduce laboratory practice as a part of the regular course of instruction, obligatory upon all students.

Chemistry.—Taught to the classical students, by text book and lectures, through two sophomore terms. In the scientific and agricultural courses, chemistry is an obligatory study throughout the course. The following instruction is given: First, a course of lectures on chemical physics and general chemistry. Second, two courses of twenty-four lectures each upon agricultural and industrial chemistry. Third, laboratory practice in qualitative and quantitative analysis and blowpiping, sixty weeks of ten hours' work each week. Special students and post graduate students do extra laboratory work.

The laboratories are as follows: One for blowpipe and qualitative analysis, accommodating twenty-five students; one for quantitative analysis, with room for twenty students; a private laboratory for the professor.

These studies were introduced into this institution by its first president, Evan Pugh, in 1860. Dr. Pugh was a graduate of Göttingen and Heidelberg, and came to the college fresh from two years devoted to original investigation in the laboratory of Messrs. Lawes and Gilbert, at Rothamstead, England. During his administration the scientific features of the college rapidly developed and the laboratories were filled with students. In the years 1862 to 1864 the regular students in laboratory practice numbered over sixty, while from fifteen to twenty advanced students were engaged in special original investigations. After the death of President Pugh in April, 1864, there occurred frequent and radical changes in the policy of the institution, under which the laboratories were dismantled of their appliances and the rooms were given over to other uses. Special students ceased to attend; and after 1866 the regular students in laboratory practice were in classes numbering less than a dozen members. Between 1864 and 1877 there were four successive professors of chemistry and physics in the college. The present incumbent, who was assistant professor under Dr. Pugh, returned to it as full professor in August, 1877. The laboratory appointments are now excellent and the trustees show a desire to encourage the depart-

ment. At the date of reporting there were eighteen students in laboratory practice, an increase of eleven within a year.

WASHINGTON AND JEFFERSON COLLEGE, AT WASHINGTON.

James Adair Lyon, professor of physics and chemistry.

Physics.—Prescribed, three hours a week, through one junior and two senior terms. Text book, Atkinson's Ganot.

Chemistry.—Taught to the junior class through the first and second terms, three hours weekly. Roscoe is used as a text book, but is enlarged upon in the class room. Analytical chemistry is an elective study, open to the senior class from September to April. Four hours a week are assigned to laboratory work, although this time is frequently exceeded. Eliot and Storer's Qualitative Analysis is used as a text book, but more work is done than is there laid down.

DELAWARE.

DELAWARE COLLEGE, AT NEWARK.

Physics.—E. D. Porter, professor of agriculture, physics, and civil engineering. Instruction in physics is confined to recitations, with class experiments, twice a week through the junior and senior years. Text book, Silliman.

Chemistry.—T. R. Wolf, professor of chemistry, geology, mineralogy, and natural history. Dr. Wolf is also State chemist and gives much time to the analysis of fertilizers. Inorganic chemistry is taught from Eliot and Storer's Manual, with supplementary lectures, three times weekly. Students in the three years' scientific course take this subject throughout their middle year, the seniors in other courses reciting with them. In the senior year the scientific students take up organic chemistry, twice a week, with Roscoe for a text book. Laboratory work is also begun in this year, and two afternoons a week are generally devoted to it. Qualitative analysis is studied with Thorpe's text book. The students in agriculture also get agricultural chemistry.

There are good facilities for instruction in quantitative analysis, but it is mainly a post graduate study and very small classes take it. Laboratory work is not required of either classical or literary students. Special students not in regular college classes may receive instruction in the laboratory.

MARYLAND.

Reports were received from St. John's College, Loyola College, Washington College, Frederick College, Western Maryland College, and the institutions described below. The essential facts concerning the above named colleges will be found in the statistical tables.

From Rock Hill College and St. Charles's College no reports were received. Their catalogues have, however, been duly consulted.

Physics.—Begun in the second term of the second year, with recitations from Balfour Stewart's text book and occasional lectures, three times a week, for four months. In the second term of the third year, Jenkin's Electricity and Magnetism is taken up and studied three hours a week during four months. In the fourth year the same amount of time is spent upon Stewart's Heat. Occasional lectures are delivered throughout the course. Every lecture is taken down by the students, and the note books are regularly examined and marked. The course is extensively illustrated by problems.

In the fourth year there are also two laboratory electives, one in electricity, three hours a week, for four months; the other in physical measurements, six hours a week (three two hour exercises), for the same time. There is a finely arranged electrical laboratory, and also an excellent laboratory for experiments in heat, light, and sound.

Chemistry.—Professor, C. E. Munroe. Required in the first term of the third year. Eliot and Storer's Manual is studied, and there is one lecture, one recitation, and one laboratory exercise each week for four months.

The foregoing is the course for cadet midshipmen. The course for cadet engineers is the same, except that these students have for twenty-three weeks five hours each Saturday in the chemical laboratory, and for eighteen weeks three exercises a week of two hours each in laboratory practice, either physical or chemical, as they may elect. If they take chemistry during the two hundred and twenty-three hours, they get through a course in qualitative analysis, a course in the quantitative analysis of ores, steel, iron, alloys, and paints, and a short course in mineralogy and metallurgy. If in the elective they take physics, they have a course of measurements in heat or electricity, and get only the Saturday work in qualitative analysis and blowpiping.

The course in natural philosophy began here in 1845 and included mechanics, optics, electricity, magnetism, and chemistry. No considerable appropriation for apparatus was made until 1850. The chemical laboratory was finished in 1875. The physical laboratory is but just completed. Previous to 1875 a small laboratory capable of accommodating ten students was used for both chemical and physical work. The new large chemical laboratory can accommodate one hundred students working in two divisions alternately, and there is besides a smaller laboratory for quantitative analysis.

Original researches have been published from these laboratories as follows: By Ensign A. A. Michelson, "Experimental determination of the velocity of light;" by Prof. C. E. Munroe, "The estimation of manganese as pyrophosphate," "The production of distilled water from service steam," and an "Analysis of the service water of Annapolis."

Torpedo Station, at Newport, R. I.

Here there is a special course of instruction for naval officers who have seen several years' service and who are believed to be fitted for the work. It lasts for three months, four hours a day, five days in the week. Professor Moses G. Farmer has charge of electricity and Professor W. N. Hill of chemistry. The course is as follows: Twenty-seven lectures on electricity and four hours a week of practical work, fifteen lectures on chemistry, ten lectures on explosives, twenty-five lectures on torpedoes and twenty-eight hours of practical work, four hours a week of lectures and practical work in fuse making. (See Report of the Secretary of the Navy for 1878.)

Since the Naval Academy is an institution different in kind and in special purpose from any of the other schools which we have to consider, a few words just here may not be out of place concerning the usefulness of science to a naval officer. It was not until years after the establishment of the Academy that physics and chemistry were added to the course of study; and although, through force of circumstances, these branches have brought themselves more and more into prominence, there is yet in the minds of many naval officers only a vague idea of their value and in some cases even a strenuous opposition to their growth in the academic curriculum. These studies are also opposed by those who regard a man's attainments in mathematics as a true measure of his ability, and who consequently look with contempt upon natural science except when it admits of mathematical discussion. It would be easy to point out the fallacies which underlie these sources of opposition, but such an argument is outside the scope of this report. The purpose of the writer is, not to show the relative value of the studies in question with reference to other studies, but their actual utility to the naval officer.

The commanding officer of a ship is the ruler of a community, the head of a household. Within the narrow walls of a vessel inclosing hundreds of men are contained all their food and water, all their clothing, and all the materials for the pursuit of their various callings. There the men eat and there they throw off their effete material, and the care of all depends upon the commander. He is responsible for the purity of their food and for the hygienic condition of their surroundings. Surely a familiarity with the results of modern scientific investigations cannot but be useful to him. Again, the instruments upon which he depends for his safety, the sextant, the compass, the chronometer, and the barometer, are purely physical instruments, and a knowledge of the principles which their construction and use involve must be of as great value to him as an acquaintance with the way in which the formulæ and the tables that he employs in his calculations were deduced. If we consider the armament, we find that here again the progress of modern science is such that the intelligent officer must become familiar with

her results. Improvements in the gun and in the torpedo can only be effected rationally by the scientific officer, and without a knowledge of chemical science the new explosives cannot be comprehended, or even used without great danger.

Furthermore, naval officers are at different times on duty in the Naval Observatory, as observers, rating chronometers, or correcting compasses. At the Hydrographic Office they compile and compare thermometrical, barometrical, and hydrometrical observations and observations on the winds, tides, and currents. They take the records of soundings and of surveys, and make charts of the ocean, bottom and surface, for the whole world. They are attached to the Coast Survey, doing all the varieties of work in which the survey is engaged; to the Bureau of Steam Engineering, designing the machinery for our ships; to gun foundries, superintending the construction of ordnance; to gunpowder mills, supervising the manufacture of powder. They are detailed in boards to inspect food, fuel, materials, and clothing. In every one of these occupations a knowledge of either physical or chemical science is advantageous and in some cases absolutely necessary.

JOHNS HOPKINS UNIVERSITY, AT BALTIMORE.

Physics.— Professor H. A. Rowland and Associate Professor C. S. Hastings, assisted by several fellows. During the academic year 1878–'79, the following classes were in operation: General physics, two experimental lectures and three recitations weekly throughout the year, Dr. Hastings; thermodynamics, thirty mathematical lectures and ten recitations, Professor Rowland; electricity and magnetism, eighty mathematical lectures and twenty-seven recitations, Professor Rowland; spherical harmonics, ten mathematical lectures, Dr. Thomas Craig; theoretical dynamics, fifteen mathematical lectures, Dr. Craig; hydrodynamics, twenty-four mathematical lectures, Dr. Craig; theory of the telescope, four lectures to astronomers and mathematicians, Dr. Hastings; laboratory work for special students, five times a week throughout the year, Professor Rowland; laboratory work, Saturday class for advanced students, once a week throughout the year, Professor Hastings; laboratory work, Saturday class in general physics, once a week throughout the year, Dr. Hastings; reading and discussion of current physical journals, once weekly through the year. The fellows and advanced students were also engaged in researches under the direction of Professor Rowland.

The physical laboratory is finely equipped and contains some of the rarest and most valuable instruments of precision. A list of the latter, not including apparatus for mere demonstration, is given in the fourth annual report of the university. The same document also contains a catalogue of the scientific papers and researches thus far published from the institution.

Chemistry.—Professor, Ira Remsen; associate professor, H. N. Morse;

assistant, L. B. Hall, and several fellows. Professor J. W. Mallet, of the University of Virginia, lectures upon technological chemistry. During the academic year 1878–'79, the following courses of instruction in chemistry were given: General chemistry, four lectures by Professor Remsen and two examinations by Dr. Morse, weekly, first half year; general chemistry continued, four lectures and two examinations weekly, second half year, Dr. Morse; laboratory work, four to eight hours daily, through the year, Professor Remsen and Dr. Morse; organic chemistry, four lectures weekly, second half year, Professor Remsen; analytical chemistry, once weekly, through the year, Dr. Morse; history of chemistry, twelve lectures, Professor Remsen; waste products of chemical manufacture, twenty lectures, Professor Mallet; history of the chief branches of chemical industry, twenty lectures, Professor Mallet; reading and discussion of current chemical journals, twice weekly, through the year.

The fellows and advanced students have also been engaged in carrying out investigations under Professor Remsen. A list of the researches thus far published is given in the fourth annual report of the university. Professor Remsen also edits, with the assistance of several other chemists, the American Chemical Journal.

The general character of the chemical work at this university may be described thus: Chemistry is taught for two purposes: first, as part of a general training; second, as a specialty. The students who are not specialists may study the science in question either for a year or for a year and three-quarters. The lectures extend through a year and a half, and they are accompanied by frequent oral and written examinations. The laboratory work occupies a year, with four hours of practice daily. The shortest course which is permitted consists of a year's lectures and a half year of laboratory work. The larger of the two courses above referred to serves as an introduction to the regular course of the specialist.

The student having been familiarized in the introductory courses with the general principles of chemistry, the reactions of chemical substances, and the leading methods used in qualitative and quantitative analysis, is now required to apply his knowledge in the making of difficult analyses and in the preparation of bodies involving the use of the most complicated processes. He is finally required to prepare a number of the typical compounds of carbon; and last of all a subject is given him the working out of which will introduce him to the method of conducting an original investigation. At the completion of this course, which occupies after the preliminary course about two years, the student may present himself, under certain prescribed conditions, for the degree of A. M. or PH. D.

Research is regarded as a very important part of every complete course in chemistry. The teaching is so directed that every student must necessarily recognize its importance. Constant reference is made

to sources of information, so that familiarity with the literature of chemistry is the first result, and from this comes a clearer notion in the student's mind of the way in which the different subjects have been built up.

Very few text books are used in the classroom, but various works upon chemistry are recommended for general reading. There is, however, a short time given to recitations from Remsen's "Theoretical Chemistry." Galloway and Classen are used almost entirely as guides in the laboratory, although the larger books are constantly employed for reference.

MARYLAND AGRICULTURAL COLLEGE, AT COLLEGE STATION.

Physics.—R. E. Nelson, professor of physics and applied mathematics. Taught in the freshman and sophomore years. The text books are Norton's Philosophy, Todhunter's Mechanics, and Bartlett's Acoustics and Optics. Lectures are delivered in addition to the text book work. The seniors have a course in Rankine's Applied Mechanics.

Chemistry.—W. D. Morgan, professor of chemistry and natural history. The freshmen have recitations and lectures upon general chemistry, both inorganic and organic. In the subsequent years of the course instruction is furnished in qualitative and quantitative analysis, blowpiping, assaying, photography, toxicology, and agricultural chemistry. There is a well arranged laboratory; and a gold badge representing a chemical implement is awarded as a prize for the best quantitative analysis by a member of the sophomore class. No research work is reported. Neither returns nor catalogue specify exactly how much chemistry is required for graduation nor how much time is assigned to the several branches of the subject.

DISTRICT OF COLUMBIA.

GEORGETOWN UNIVERSITY.

Physics.—The graduating class study Atkinson's Ganot, six hours weekly, throughout the year. Lectures, with experiments by the professor, are given five days in the week. On Saturday there are two half hour lectures by students, with repetition of the experiments. Problems have not lately been assigned to students, but probably will be in the future.

Chemistry.—Begun in the sophomore year. One year is devoted to inorganic chemistry, and a second to organic chemistry and analysis. Laboratory practice is obligatory upon all students.

Physics was a part of the regular course in this institution as early as 1817. In 1834 chemistry was introduced, but was confined to the senior class. In 1873 it was brought forward to the place which it now occupies. Special prizes for excellence are awarded in both subjects.

COLUMBIAN UNIVERSITY AND HOWARD UNIVERSITY.

The work done in chemistry and physics at these institutions is sufficiently described in the statistical tables. The former has the more advanced classes and offers facilities for optional laboratory practice.

NATIONAL DEAF-MUTE COLLEGE.

Professor J. C. Gordon has charge of both chemistry and physics.

Physics.—Studied from an elementary text book two terms of the preparatory year, and also from Snell's Olmsted one junior term. The juniors also give one term to mechanics, using the same author. The apparatus in the laboratory affords the means of illustrating the principal phenomena, and students are expected to make the experiments themselves as far as possible.

Chemistry.—The sophomores memorize an elementary text book in order to gain a knowledge of the principles, theories, symbols, and nomenclature of the subject. This work is accompanied or followed by illustrative experiments, which include the course recommended by Frankland.

The juniors are required to do laboratory work, following the syllabus prescribed for the elementary stage in the English examinations at South Kensington. Eliot and Storer's text book in qualitative analysis is taken up in the last term of the year. The students take notes of the work performed and submit monthly reports. The laboratory is fitted up with the necessary apparatus, instruments, chemicals, and books of reference.

VIRGINIA.

In addition to the institutions described in the text, reports were received from Randolph Macon College and Emory and Henry College.

No returns were sent in by Hampden Sidney College, Richmond College, Roanoke College, the College of William and Mary, the Newmarket Polytechnic Institute, or the Virginia Agricultural and Mechanical College. The catalogues of some of these institutions, however, have been consulted in making up the statistical tables.

UNIVERSITY OF VIRGINIA, AT CHARLOTTESVILLE.

Physics.—Professor F. H. Smith. There are two courses of lectures, each extending through the session of nine months, unbroken by vacation. One course, of three lectures a week, each an hour and a half long, is devoted to general physics, discussed and illustrated experimentally and with the aid of the simpler mathematics. The other course, of three lectures a week, each an hour in length, is devoted to mechanics and astronomy, studied with the aid of the higher mathematics.

At the beginning of each lecture the professor questions the class on the subject of the preceding lecture. He thus occupies about one-third of the time and addresses the students upon new matter during

the remaining two-thirds. It can scarcely be said that text books are used as such, the books so designated being rather employed for frequent reference, as others for occasional consultation, while the personal oral teaching of the professor is the principal basis of the course.

The laboratory teaching in physics is both theoretical and practical. On the theoretical side, instruction is given in the reduction of observations, the graphical representation of results, interpolation, and so on. The practical work embraces physical manipulation, measurements with instruments of precision, the investigation of physical laws, &c.

When sufficiently advanced, students are encouraged to take up simple questions requiring original research. The teaching is oral and informal, with frequent personal aid from the professor and reference to any books that may be needed. The time occupied is practically limited only by the demands upon the student arising from his work in other departments of the university.

In former years physics has been taught in the University of Virginia by the following professors: Charles Bonnycastle, R. M. Patterson, and William B. Rogers.

Chemistry.—Professor J. W. Mallet. Adjunct Professor F. P. Dunnington has the immediate charge of the laboratory work.

There are two main courses of lectures, each course of three lectures a week for nine months. Each lecture is an hour and a half long. One course is devoted to general or scientific chemistry, illustrated experimentally. The other course is upon industrial or applied chemistry, and is illustrated by models, diagrams, experiments, and so on. There is also a short course of lectures, three weekly for about six weeks, on agricultural chemistry.

The time occupied at each exercise in questioning the class upon the subject of the preceding lecture is about one-third of the whole. In the class of general chemistry it has for several years been the practice to concentrate all the questioning upon one day in the week (thus preserving the correct proportion of time) and on this occasion to encourage the asking of questions by the students, and, as far as possible, to review in a conversational way, as in the discussions of a scientific society, the subjects last brought forward in the formal lectures. No lessons in text books are ever assigned; but the students are expected to read a good elementary treatise parallel to the lectures, and are advised to refer to more extended works at their disposal in the library. The meaning and practical use of formulæ are often called for, and stoichiometrical problems are from time to time given out to the class.

In the laboratory, occupying a specially built brick building capable of accommodating fifty students, there are two principal classes in analytical chemistry. Each class continues through the entire session of nine months. To one class is given a course in chemical manipulation and qualitative analysis, of two lessons a week, each of three or four hours' duration. The student has permission to occupy a longer

time afterwards by himself, if he chooses to do so. The other class has a full course in qualitative and quantitative analysis, students in which are free to work in the laboratory six days in the week, from 9 A. M. to 5 or 6 P. M.

The laboratory instruction is personal, under the immediate charge of the adjunct professor of analytical chemistry and the general supervision of the professor. Students are strongly urged to undertake original research; the chief difficulty in the way of this being, here as elsewhere, the short time for which reasonably advanced pupils can generally be induced to remain, in the face of the temptations held out for active employment in society. The attempt is made, however, even with beginners, to show that the best answer to a doubt as to matter of fact may be obtained by direct experiment rather than by mere reference to authority; and simple bits of original investigation are easily devised, which may at least do the student good by teaching him what such work means. The fruit of this policy may be seen in the considerable number of original memoirs which have been published from this laboratory.

In addition to the foregoing there is a short course for medical students in the clinical applications of practical chemistry. The laboratory is also open to students for special work, such as assaying, technological research, &c.

It is to be remarked that absolute freedom of choice as to the studies to be pursued has always been allowed to every matriculate at the University of Virginia since its foundation. Hence it is not easy to describe its system of instruction in terms readily comparable with those commonly used as to other institutions of learning where prescribed courses of combined or successive studies are laid down. Independent diplomas are given for the satisfactory completion of particular subjects; and such may be obtained by the student in either the lectures or the laboratory work of either physics or chemistry. The requirement for the acquisition of such a diploma is the passing, with a fixed standard of merit, two examinations; written for the lecture course, practical for laboratory work, the one near the middle, the other at the end of a session. The time occupied by a written examination is about seven or eight hours, but in one of practical character may extend over several days.

Former teachers of chemistry have been as follows: Professor John P. Emmet, Professor Robert E. Rogers, Professor J. Lawrence Smith, Professor S. Maupin, Assistant Instructor D. K. Tuttle.

WASHINGTON AND LEE UNIVERSITY, AT LEXINGTON.

Physics.—Harry Estill, professor of natural philosophy and acting professor of applied mathematics. Required for the degrees of B. S., M. A., or C. E. Elective for the degrees of B. P. or A. B. The study is distributed between two classes, the junior and the senior, each of which

meets the professor five times a week. In the junior class the work for the first half session is confined to recitations with experimental illustrations. Text book, Balfour Stewart. During the second half session the professor dispenses with a text; and, confining himself to some special branch of his subject, develops it by lectures and experiments as far as possible. The junior class is expected to be a class of experimenters, in whose labors the professor will assist.

The senior class must understand the ordinary processes of mathematics. For the first term Bartlett's Analytical Mechanics is studied. The mechanical theory of heat, the undulatory theory of light, or some similar subject will be investigated during the second term.

The apparatus is extensive and new, having been constructed at Paris under the special direction of the professor.

Chemistry.—J. L. Campbell, professor of chemistry, mineralogy, and geology. The chair was specially endowed, in 1826, with the sum of $40,000, given by John Robinson. Chemistry is required or elective for the various degrees precisely like physics. The course of instruction embraces chemical physics; theoretical, inorganic, organic, and physiological chemistry; lectures upon agriculture; and the history of the origin and development of chemical science. Text books, Roscoe and Fownes. The class meets the professor in the laboratory six times a week for recitations and lectures. The latter are elaborately illustrated by experiments. The recitations are both written and oral, and problems are frequently assigned. Exercises in laboratory work will be given hereafter.

A prize medal is given for proficiency in natural philosophy, chemistry, and applied mathematics.

VIRGINIA MILITARY INSTITUTE, AT LEXINGTON.

Physics.—The report merely states that instruction is given by recitations and lectures, chiefly by text book.

Chemistry.—Professor, M. B. Hardin, with an adjunct and one or two assistants, according to the number of students. In the regular academic course, chemistry is begun, as a required study, in the third year. The subjects taken up are general descriptive chemistry, both inorganic and organic; chemical philosophy; and laboratory practice. The latter embraces preparative work, blowpipe analysis, Bunsen's flame reactions, and elementary qualitative analysis. Two hours every other day are given to laboratory work throughout the year. The full course is required of all students. Occasional lectures are also given upon the applications of chemistry to agriculture, manufactures, &c. Text books, Roscoe and the "Owens College Junior Course."

In addition to the foregoing there is a special course in chemistry, embracing both qualitative and quantitative analysis and assaying. The laboratory is fitted up to accommodate seventy students.

The present system of chemical instruction began in 1858; previously

the teaching was chiefly by lectures. Several investigations are reported, mostly analyses of mineral springs, waters, ores, Virginia plaster, &c.; also, two papers entitled as follows: "On certain flame reactions of silver."—Proc. Am. Chem. Soc., May 3, 1877. "On the determination of calcium as carbonate after precipitation as oxalate."—Same journal, July 11, 1878.

WEST VIRGINIA.

A report was received from West Virginia College, at Flemington. Only elementary work in chemistry and physics is done here, and it is sufficiently described in the statistical tables.

BETHANY COLLEGE, AT BETHANY.

J. F. Eastwood, professor of natural sciences.

Physics.—Required in the classical course during the first half of the senior year. In the scientific course it is studied through the second junior and first senior terms, with practical physics in the second senior term. Text book, Ganot.

A physical laboratory has been fitted up, and a special course is given in experimental philosophy for the benefit of teachers wishing such instruction. The course occupies from six to ten weeks, and for it a fee of twenty-five dollars is charged. It embraces the verification and illustration of physical laws and covers the physical and chemical properties of matter, sound, light, heat, electricity, magnetism, and the conservation and correlation of forces. Each student performs all the experiments himself, and keeps a record describing minutely the work done and explaining the phenomena observed. On completing the course he is examined; and if proficient he may receive a certificate of proficiency upon payment of two dollars.

Chemistry.—In the classical course Eliot and Storer's text book is studied during the second junior term. In the scientific course, during the same term, Roscoe is used, and laboratory practice is required through the first half of the senior year. The latter consists of four months in qualitative analysis and about one month in quantitative analysis, one hour daily. Courses in toxicology and urine analysis are provided, but are not required in the regular curriculum.

There is also a special course in practical chemistry, for which a certificate is given. It is, briefly, as follows: (1) Qualitative analysis, the examination of a hundred substances; (2) mineralogy, the determination of a hundred minerals with the blowpipe; (3) quantitative analysis; (4) assaying; (5) pharmacy, the preparation of medicinal agents—acidimetry and alkalimetry. The course in qualitative analysis must precede any of the others. After it a student may take one or all of the remaining branches, and his certificate will indicate the character of the work done. The cost of qualitative analysis will be about twenty-

four dollars, and of mineralogy, ten dollars. For the other branches the charge is proportional to the amount of materials used. No original researches are reported.

WEST VIRGINIA UNIVERSITY, AT MORGANTOWN.

This institution failed to report. Its catalogue, however, indicates the usual amount of work in chemistry and physics in all courses, with two terms of analytical chemistry and two terms of analytical mechanics in the scientific course additional.

NORTH CAROLINA.

Besides the institutions described below, Rutherford College and North Carolina College reported. See the statistical tables.

Biddle University, Wake Forest College, and Weaverville College neglected to report.

UNIVERSITY OF NORTH CAROLINA, AT CHAPEL HILL.

Physics.—Professor R. H. Graves. Professor Graves also teaches analytical geometry and calculus. Physics is required of all candidates for degrees, three times a week, during the junior year. Mechanics and astronomy occupy between them the same amount of time in the senior year. Text books, Deschanel, and Todhunter's Mechanics for Beginners.

Chemistry.—Professor A. F. Redd. Required in the junior year of the classical and philosophical courses, elective during the senior year. In the scientific course it is required through the sophomore and junior classes. A gold medal is given to the most successful student of chemistry.

The first year in chemistry is divided into two courses, a lecture course and a laboratory course. In the former the class meets the professor three times a week throughout the scholastic year, to study chemical physics, chemical philosophy, and general chemistry, inorganic and organic. The instruction is given by text books and by lectures, with numerous experiments. Text books, Fownes and Roscoe. In the laboratory course the students spend six hours a week with the professor throughout the scholastic year, working upon qualitative analysis. A deposit of $12 is required at the beginning of the session to defray the cost of apparatus and chemicals.

In the second year's course quantitative analysis is studied and lectures on industrial chemistry are given twice a week. The work of the year may follow such directions as the student elects, and special courses are laid out in agricultural, analytical, manufacturing, medical, and pharmaceutical chemistry. The average expense of taking the druggists' and physicians' course is $30.

The North Carolina Agricultural Experiment Station is connected

with this university. It is in charge of Professor A. R. Ledoux, with three assistants. Here fertilizers, soils, marls, mineral waters, and agricultural products are analyzed.

The university was first opened in 1795. Chemistry and physics were introduced into the course in 1818, Dr. Denison Olmsted, afterwards of Yale College, being the first professor. The university was suspended during the civil war, and did not reopen until 1875.

DAVIDSON COLLEGE.

Physics.—J. R. Blake, professor of natural philosophy and astronomy. The study is begun in the sophomore class with recitations from Atkinson's Ganot and lectures by the professor. There are three exercises a week throughout the year. Problems are assigned and experiments are freely used. The junior class recite twice a week during the entire year in Peck's Mechanics.

Chemistry.—The professor, whose name is not reported, teaches also geology. Barker's text book is studied by the juniors in connection with lectures by the professor. Constant effort is made, by illustration, experiment, and the working of problems, to render the students familiar with principles. The senior class spend three hours a day for three days in the week upon practical work in the laboratory. Fresenius's Qualitative Analysis is the text book used. Graduate students receive free tuition.

SOUTH CAROLINA.

Reports were received from the College of Charleston, Newberry College, and Wofford College. None of these colleges attempts advanced scientific work or offers laboratory facilities to students. Their work is sufficiently described in the statistical tables.

The University of South Carolina, Erskine College, Furman University, and the South Carolina Agricultural College and Mechanics' Institute (Claflin University) failed to report. The catalogues of the University of South Carolina and of Furman University, however, indicate that these institutions are provided with laboratories and that they offer instruction in chemical analysis.

GEORGIA.

Atlanta University and Pio Nono College reported, but they offer no laboratory facilities for students. For the data supplied, see the statistical tables. The University of Georgia reported fully and is described below.

The North Georgia Agricultural College, Bowdon College, Gainesville College, Mercer University, and Emory College did not report. The catalogues of all but Bowdon College have, however, been used in the work of tabulating.

UNIVERSITY OF GEORGIA, AT ATHENS.

Physics.—L. H. Charbonnier, professor of natural philosophy, astronomy, and engineering. There are three classes in physics, one for juniors and two for students in the senior year. During the junior year the class meets the professor three times a week, and studies, in succession, mechanics, hydrostatics, and hydrodynamics, acoustics, light, and heat. Text book, Atkinson's Ganot. The students are regularly examined upon the text, which is explained and expanded by the professor in familiar or formal lectures; and, while great stress is laid upon fundamental principles, the course is largely experimental and the applications of science to practical life are constantly indicated. This course is required of all regular candidates for degrees. The senior course in natural philosophy and astronomy is taken by candidates for degrees in science and engineering during their junior year, but by all other students during the senior year. The class meet twice a week, and study meteorology, magnetism, electricity, and astronomy. This course is also fully illustrated by experiments. The senior course in mechanics and astronomy is only prescribed for the scientific and engineering students. The class meet the professor three times weekly, to study spherical astronomy and analytical mechanics.

Chemistry.—H. C. White, professor of chemistry, mineralogy, geology, and agriculture. There are two classes in this subject, the junior and the senior. The students of the junior class study general chemistry, meeting the professor three times a week for ten months. Subjects are taken up in the following order: (1) The non-metallic elements; their history and their combinations with each other. (2) The principles of chemical nomenclature, symbols, and notation; the general principles of chemical philosophy. (3) The metals; their history, combinations, &c. (4) Organic chemistry. Text book, Fownes. This course is illustrated experimentally, and practical applications of the several subjects are duly noted. The senior class meet also three times a week for ten months, and study organic, industrial, and agricultural chemistry. Industrial chemistry is taught by lectures, illustrated by specimens, models, and drawings. The lectures upon agricultural chemistry begin about the first of April, and are free to the public, in accordance with the terms of the Terrell endowment. In this course the following subjects are presented: (1) The chemistry of the plant; (2) the anatomy and physiology of the plant; (3) the chemistry of the atmosphere; (4) the chemistry of the soil and its physical properties influencing agriculture; (5) means of improving the soil and influencing the growth of plants (farmyard manures, commercial fertilizers, &c.).

There is also a class for practical work in the laboratory. This class meets three times a week, spending on each occasion from two to four hours in actual practice. A thorough course of manipulation, blowpipe analysis, qualitative and quantitative analysis, is thus offered to students of the university.

The following course of study leads to the degree of bachelor of chemical science:

Freshman class.—English, algebra, geometry, drawing, history, botany.

Sophomore class.—English, algebra and geometry completed, history, book-keeping, geometrical drawing, elements of mechanics, trigonometry, mensuration and surveying (with practical exercises), botany, zoölogy, agriculture.

Junior class.—General chemistry; laboratory practice in manipulation, blowpipe analysis, and qualitative analysis; physics; English and English literature; French; German.

Senior class.—Industrial chemistry, including mining and metallurgy, chemical manufactures, &c.; agricultural chemistry; quantitative analysis, gravimetric and volumetric; physics; astronomy; French; German. The student is obliged to spend at least five hours a day in the laboratory, six days of the week.

In the agricultural course the students are engaged in the laboratory six hours a week through the junior and senior years. Their work is necessarily in those portions of chemistry most directly related to agriculture.

The city of Athens contributed $25,000 for the erection of a laboratory building. This is a three story structure with a basement covering an area of one hundred by fifty feet. The entire first floor and basement are occupied by the department of chemistry, and contain analytical laboratories, balance rooms, an assay room, a room for microscopic and spectroscopic work, an industrial museum, store rooms, engine room, workshop, printing office, &c. The second floor contains a lecture room and museum for the department of agriculture, with an apparatus room, working room, and lecture room for the department of physics. The third floor is devoted to the department of engineering and drawing. The laboratories are open to students the whole of each day. A fee of $15 is charged to each student for the use of chemicals. A common set of ordinary apparatus is furnished at a cost not exceeding $10. Special students may, by permission of the faculty and payment of a fee of $35, take a course of chemistry alone, including lectures and laboratory practice.

The industrial collection of the university is quite extensive, numbering over four thousand items. It well illustrates the applications of chemistry to the useful arts and is made a prominent feature in the organization of the chemical department.

A few researches are reported upon such subjects as analyses of the cotton plant, of Georgia marls, tests of strength of Georgia timber and iron, and so on. The university was founded in 1800 and the sciences were taught from the beginning. In 1870 laboratory work was introduced, and it has since been made a part of the regular college curriculum. Chemistry and physics are not taught in the elementary schools of Athens.

ALABAMA.

The institutions described in the text were the only ones reporting. Southern University, Howard College, and Spring Hill College neglected to report. Their catalogues indicate only elementary work.

UNIVERSITY OF ALABAMA, AT TUSCALOOSA.

Physics.— Joshua H. Foster, professor of natural philosophy and astronomy. Required in both regular courses of study through the junior year; also, in the scientific course during the first senior term. The classical students use Peck's Ganot for a text book, while those in the scientific classes use Snell's Olmsted. There is a general course of popular experimental lectures, covering the subjects of hydrostatics, pneumatics, sound, magnetism, electricity, heat, light, and meteorology; and this alone is required of the classical students. The scientific course involves, additionally, the rigid application of mathematics, and embraces astronomy. Mechanics is taught in the first half of the senior year. There is no physical laboratory work, although there is a good collection of apparatus.

Chemistry.— Eugene A. Smith, professor of chemistry, mineralogy, and geology and State geologist; Henry McCalley, assistant instructor in chemistry. In this university there are two courses of instruction in chemistry. First, there is an experimental course of lectures, three a week, without laboratory practice. It covers the general principles of the science and is intended for students of the classics and others who desire only an elementary knowledge of chemistry. This course is given in the junior year.

The second or special course is one of laboratory instruction, and at present covers two years. From six hours a week upwards is spent in actual practice, and the work includes chemical manipulation, qualitative analysis, and quantitative analysis. Formerly this course occupied three years, the retrenchment having taken place but recently.

Two large rooms are fitted up with the usual laboratory appliances and provided with all the apparatus, chemicals, &c., needed for an analytical course. The laboratory is open to graduate students, and one or two have availed themselves of the privileges thus offered.

The only research work reported consists of analyses of coals, ores, rocks, limestones, &c., made in connection with the State geological survey.

AGRICULTURAL AND MECHANICAL COLLEGE OF ALABAMA, AT AUBURN.

Physics.—Professor P. H. Mell, jr. The fourth class in the courses of agriculture, literature, science, and engineering study Balfour Stewart's Lessons in Elementary Physics. Frequent experiments are performed before the students and many illustrations are given outside of the text. The object is to furnish a foundation for subsequent higher study. The second class in all the regular courses study Snell's Olmsted. Half the

hour is devoted to a close examination upon text and notes, and the remainder of the time is given to a lecture with experiments.

Chemistry.—Professor William C. Stubbs. The third class in all regular courses study general chemistry. There is a full course of experimental lectures, based upon Bloxam's work as a text book. The second class in the courses of agriculture and science take up analytical chemistry in the laboratory. The first class in science have instruction in quantitative analysis, both gravimetric and volumetric. The corresponding grade of students in agriculture study agricultural chemistry, with laboratory practice in the analysis of soils and soil products.

The laboratory is provided with twenty-eight working tables supplied with gas and water. The outfit of apparatus and chemicals is ample.

Some investigations have been made in this college relative to the soils of Alabama, the composition of native grasses, the analysis of commercial fertilizers, and so on.

MISSISSIPPI.

From Mississippi College, at Clinton, no report was received. Its catalogue does not indicate advanced work in either of the sciences under consideration. Shaw University and Alcorn University reported, and are described sufficiently in the statistical tables.

UNIVERSITY OF MISSISSIPPI, AT OXFORD.

Physics.—Robert B. Fulton, professor of physics and astronomy. This study is required in the A. B. and B. S. courses, but is optional in the course leading to the PH. B. degree. The B. A. and B. S. students begin the subject with their junior year, reciting together daily, except on Saturdays and Sundays. For two or three months they are drilled upon the mechanics of solids, as contained in Peck's text book. Particular attention is given to the solving of problems, and occasional lectures are delivered explanatory of the text or enlarging upon it. They next take up Atkinson's Ganot as a class book, studying the general properties of matter and energy and the mechanics of solids so far as it was not treated in the former text book. They then take all the text relating to the mechanics of liquids and gases, acoustics, and heat. In using the text books, a certain portion is assigned for study, and at the next hour, if the matter needs illustration by experiments, the apparatus is placed before the class and students are called upon to describe the mode of experimentation before the work begins. Occasional lectures are given on matter entirely outside the text and also in the form of current notes upon nearly every lesson. Students are required to keep a record of these.

In the senior year the same classes attend together three times weekly to study light and electricity from Ganot's text, after the above method. The problems are required to be solved throughout both years. The latter part of the time in the senior year is given to astronomy.

In addition to the foregoing the senior B. S. class do extra work in physics, twice weekly, and may be with the professor as much as two hours each time. The work thus done by them is selected so as to proportionally enlarge their course, and usually consists of extra problems and laboratory work. For example, the class has recently been engaged in an investigation of the relative merits of different styles of kerosene lamps as sources of light.

Special work, theoretical or practical, is assigned to students studying for the graduate degrees of A. M. or PH. D. In these courses physics is optional.

The physical apparatus is very complete and valuable. A description of it is given in the university catalogue.

Chemistry.—R. W. Jones, professor of chemistry and natural history; T. D. Greenwood, tutor. Required in all prescribed courses. During the junior year four lectures a week are delivered through the session of nine months, making about one hundred and forty lectures in all. Collateral readings in such a work as Fownes's are daily assigned, and the students are examined upon both lectures and text book. Subjects are copiously illustrated by experiments performed by the professor before the class. The course covers general chemistry, both inorganic and organic, including the philosophy of the subject, its theories, and its methods, and the description of important elements and compounds. Problems are continually given to the students for solution.

Juniors in the B. S. and PH. B. courses devote four hours a week throughout the session of nine months to practical work in the laboratory. This course embraces general manipulations, blowpipe analysis, and qualitative analysis. In the senior year four hours a week for eight weeks are given to determinative mineralogy.

The laboratory is large and well equipped. It is provided with gas, apparatus for rapid filtration, furnaces, &c. At present there are in the university about fifty students pursuing the study of chemistry. Special students in this department pay $75 for chemicals and apparatus and $25 for damages.

LOUISIANA.

Straight University and Jefferson College reported. See the statistical tables.

St. Charles College, the Centenary College of Louisiana, and Leland University neglected to report. Their catalogues have, however, been consulted.

The Louisiana State University and Agricultural and Mechanical College also failed to report. Its catalogue indicates a two years' course in chemistry, covering inorganic, organic, applied, physiological, and agricultural chemistry, and analysis. This necessarily implies a laboratory. Physics is also provided for, and is apparently taught with a decided mathematical bias.

TEXAS.

Reports have been received from the Texas Military Institute, Southwestern University, and Baylor University. Only elementary work is indicated by these returns, and they are sufficiently described in the statistical tables.

St. Joseph's College, Henderson Male and Female College, Austin College, Mansfield Male and Female College, Salado College, Trinity University, Waco University, and the State Agricultural and Mechanical College neglected to report. Such facts as are given concerning these colleges have been gleaned from their catalogues.

TENNESSEE.

Reports were received, in addition to those of the institutions described below, from Beech Grove College, Southwestern Presbyterian University, Hiwassee College, Southwestern Baptist University, Bethel College, Manchester College, Maryville College, Christian Brothers' College, Mosheim Institute, Central Tennessee College, and Greeneville and Tusculum College. The essential facts of these reports are embodied in the statistical tables.

East Tennessee Wesleyan University, Bradyville College, King College, Mossy Creek Baptist College, and Woodbury College neglected to report.

UNIVERSITY OF TENNESSEE AND STATE AGRICULTURAL COLLEGE, AT KNOXVILLE.

Physics.—S. H. Lockett, professor of mathematics and mechanical philosophy. Eighty hours are given to lectures and recitations upon elementary physics in the scientific and classical courses. Text book, Balfour Stewart. Later, one hundred and twenty hours are occupied with advanced and molecular mechanics, studied by means of the calculus. The latter work is done in the B. S. mechanical course. Experiments are performed before the classes, but no laboratory work is done by students, the apparatus not permitting it.

Chemistry.—W. G. Brown, professor, with W. E. Moses, assistant. Students in the agricultural, mechanical, and classical courses have eighty hours of lectures and recitations—two a week throughout the session—in chemical physics and descriptive inorganic chemistry. Text book, Roscoe. In the scientific course there are one hundred and twenty hours, or three a week, of lectures and recitations in organic and industrial chemistry. These two classes see the usual experiments in the class room.

The scientific course students also have six hours a week, for a year, of laboratory practice in qualitative analysis. In the agricultural course nine hours a week for a year are devoted to quantitative analysis, and forty hours altogether are given to lectures and recitations upon

agricultural chemistry. Advanced work is also done by candidates for degrees in civil, mining, and mechanical engineering.

The laboratory facilities are fairly good. Fifteen students at a time can be accommodated. The laboratory is open to special students in chemistry, who may undertake work relating to any branch of the science, whether agricultural, metallurgical, medical, or technological. A preliminary knowledge of chemical theory is, however, required. The lectures upon agricultural chemistry are open, free of charge, to farmers and others who may be interested in the subject.

A few researches are reported: namely, by Professor Burton, upon a meteorite from North Carolina and upon analyses of Tennessee iron ores, and by Professor Brown upon philipium. The last named paper appeared in the Chemical News, vol. 38, p. 267.

CUMBERLAND UNIVERSITY, AT LEBANON.

In addition to the usual elementary courses in chemistry and physics, special instruction is furnished in qualitative and quantitative analysis.

FISK UNIVERSITY, AT NASHVILLE.

In addition to the usual courses, an occasional scientific student takes a five months' course in qualitative analysis. Professor Chase is endeavoring to secure opportunity and apparatus for introducing the laboratory system in physics.

VANDERBILT UNIVERSITY, AT NASHVILLE.

Physics.—L. C. Garland, chancellor, and professor of physics and astronomy. This study occurs in the junior and senior years, and is to some extent obligatory upon all candidates for collegiate degrees. There are two classes. First, an elementary class, which attends five lectures a week throughout the year. The subjects discussed are the general properties of matter; physical units, instruments, and methods of precision; the doctrines of motion, force, and energy; the mechanics of solids, liquids, and gases; molecular forces, cohesion, adhesion, capillarity, elasticity, &c.; the theory of undulations; acoustics, and heat. In the second year's class, magnetism, electricity, and optics are taken up, and three lectures a week are attended. Algebra, geometry, trigonometry, and conic sections are required for admission to the first class.

The collection of physical apparatus is unusually large and valuable. No laboratory work by students is, however, reported. No original researches in physics have yet been published from this university.

Chemistry.—Professor N. T. Lupton. A certain amount of chemistry is required in all courses of study leading to collegiate degrees. Instruction is given as follows: *General chemistry.*—Five lectures a week, with experiments, throughout a scholastic year, covering a discussion of the fundamental principles of chemical philosophy; the history,

preparation, properties, and compounds of the elements; and the main facts and conceptions of organic chemistry. The more common applications of chemistry to the arts and manufactures are also described in this course. *Applied chemistry.*—Three lectures a week for a year. *Analytical chemistry.*—The laboratory course covers both qualitative and quantitative analysis, and is varied in its details to suit the individual needs of students. Special students may be admitted to this course.

The laboratory facilities are good, comprising a large analytical room, a balance-room, a room for gas analysis, and a room for assaying. The apparatus room and professor's laboratory adjoin the lecture room. The laboratory tables are fitted with both gas and water, one washbowl for every two students. Every opportunity is offered for post graduate work and research, but no completed investigations are yet reported.

A fee of $50 a session is charged for instruction in analytical chemistry and for the material consumed. A short course in qualitative and blowpipe analysis is, however, given for $10. Breakage is secured by an advance deposit of $10 by each student, and at the end of a course the amount of damage is deducted from this sum.

There are now, in October, 1879, sixty-one students of general chemistry, nine of applied chemistry, and twenty-three in the laboratory. The university has been open four years. The first year there were three laboratory students; the second, eight; the third, ten; and the fourth, thirteen. A gratifying increase is thus shown.

UNIVERSITY OF THE SOUTH, AT SEWANEE.

Physics.—John McCrady, acting professor. Professor McCrady also has charge of biology, civil engineering, and the relations of religion to science. Physics is required for the degrees of C. E., B. A., and B. S., but not for the B. L. degree. The full course occupies two years. The first year includes only elementary instruction in mechanics, heat, light, electricity, &c. Text book, Atkinson's Ganot. The second year's work presupposes a knowledge of mathematics and includes the study of Peck's Mechanics and the portions of Deschanel relative to sound and light.

Chemistry.—John B. Elliott, professor of chemistry and acting professor of geology and mineralogy. Chemistry is required for all degrees except that of B. L. The full course occupies four terms, three of which are prescribed for the B. A. degree and all four for the degree of B. S.

The first term is devoted to chemical physics, including heat, light, electricity, and magnetism; the second, to inorganic chemistry and chemical philosophy; and the third, to organic chemistry. Text book, Fownes. The fourth term is given to a course in qualitative analysis adapted from Fresenius. The work of the third and fourth terms may be done in the same term.

KENTUCKY.

In addition to the colleges described below, reports were received from Berea College, Georgetown College, Concord College, and Bethel College. See the statistical tables.

St. Joseph's College, Cecilian College, Eminence College, Murray Male and Female Institute, Kentucky Classical and Business College, and St. Mary's College failed to report.

CENTRE COLLEGE, AT DANVILLE.

J. C. Fales, professor of natural and physical science.

Physics.—Taught from Snell's Olmsted, with lectures and experiments.

Chemistry.—There is the usual course of elementary chemistry: inorganic and theoretical, according to Barker's text book; organic, by lectures. Elementary qualitative analysis, one hour a week, is required in the regular course. Instruction is also furnished in quantitative analysis. Students proposing to study medicine take extra work in Attfield's Chemistry and work in the laboratory an hour daily, five days in the week, for seventy weeks.

KENTUCKY MILITARY INSTITUTE, AT FARMDALE.

Professor R. H. Wildberger. Physics occupies one hour a day for forty weeks. Chemistry, theoretical and inorganic, is taught according to Barker. There is a course in qualitative analysis and determinative mineralogy. Altogether, two hours a day is given to chemistry for forty weeks, one-half of the time being devoted to work in the laboratory. Both subjects have been taught here since 1850, but they have received increased attention since 1874.

KENTUCKY WESLEYAN COLLEGE, AT MILLERSBURG.

Physics is taught through the greater part of the last preparatory year and in the first half of the senior year. The sophomore class have general chemistry, inorganic and organic, for the first six months of the year, with lectures and experiments on alternate days. Through the remainder of the year they study practical chemistry, but this is optional for graduation.

CENTRAL UNIVERSITY, AT RICHMOND.

There is a one year course in physics, with experiments. One year is given to inorganic chemistry and another to applied chemistry, qualitative analysis, blowpipe work, and mineralogy. The present courses began in the session of 1874–'75. Professor T. W. Tobin has charge of both studies. He reports one original investigation, entitled "The new sine pendulum for determining the earth's rotation."

AGRICULTURAL AND MECHANICAL COLLEGE OF KENTUCKY, AT LEXINGTON.

Robert Peter, professor of chemistry and experimental philosophy and chemist to the State geological survey. Mathematical physics,

mechanics, &c., are taught by J. G. White, the professor of mathematics. Instruction in chemistry and physics is given to regular classes as follows:

Junior class.—First term: Lecture or recitation daily upon elementary general physics and chemical physics, with experimental illustrations and applications. Second term: The same, continued into elementary chemistry.

Senior class.—First term: Snell's Olmsted's Mechanics. Both terms: Lecture or recitation daily upon general chemistry with its applications to agriculture, medicine, and the mechanic arts. Full experimental illustration.

Full instruction is offered in practical chemistry. Each student is charged breakage and a small additional fee for the course. Comparatively little of this work has been done as yet, but it will no doubt be regularly required in the future. No researches are reported except such as the professor has carried out in connection with the State geological survey, the board of health, &c.

At present the college is in a transition state. Until recently it has been connected with the denominational Kentucky University. It is now, in consequence of an act of legislature, detached from the latter institution, and is just beginning an independent existence. It has already received special endowments and is immediately to erect new buildings. Until these buildings are finished, the character of instruction must remain as it is. It is hoped that the severance of the two dissimilar organizations may open a new era for the college.

Natural philosophy was taught in the old Transylvania Seminary, the forerunner of Transylvania University and Kentucky University, as early as 1794. Chemistry was not mentioned in the schedule of studies of that time. In 1799, Samuel Brown was appointed professor of chemistry, anatomy, and surgery in the newly organized medical school of the university.

ARKANSAS.

The report from Judson University is adequately summarized in the statistical tables.

Arkansas College, Cane Hill College, and St. John's College failed to report. Such facts as could be collected from catalogues have been used in the tabulation.

ARKANSAS INDUSTRIAL UNIVERSITY, AT FAYETTEVILLE.

F. L. Harvey, professor of natural sciences and chemistry; C. P. Conrad, adjunct professor.

Physics.—The work in this department is shared between the professor of chemistry and the professor of mathematics. Taught throughout the senior year with Atkinson's Ganot as the text book. Lectures are also delivered. There is some physical apparatus, but no physical laboratory.

Chemistry.—Chemical physics is studied in all the regular courses during the first term of the sophomore year. During the same term the classical students have a short course of lectures upon general chemistry, without laboratory work. Students in the scientific, agricultural, and engineering courses pursue inorganic chemistry during the second and third sophomore terms. They have three recitations a week, with ten hours a week of laboratory practice, and make in all about three hundred experiments each. They pay for the chemicals used and for the apparatus broken. Organic chemistry occupies the first term of the junior year, and is taken by candidates for all degrees except that of A. B. It is taught by text book and lectures.

Qualitative analysis is taught in the third junior term to students in the scientific, agricultural, and engineering courses. It requires six hours a week of laboratory work, with recitations upon the principles involved. The same classes of students take up quantitative analysis during the first term of the senior year. In this course, agricultural students confine themselves to analyses of soils, fertilizers, food for animals, &c., while engineering students examine ores, building materials, natural waters, &c.

Industrial chemistry occupies the whole length of the senior year, and is taken by students in the three last mentioned courses. The work consists of lectures and the study of dictionaries and technological journals. Students taking the course in agriculture study agricultural chemistry during the junior year.

The chemical laboratory contains tables for thirty-two students. About one hundred students annually receive instruction in either chemistry or physics.

OHIO.

In addition to the institutions described in the text, reports were received from Ohio University, German Wallace College, St. Xavier College, Kenyon College, Denison University, Hiram College, Marietta College, Franklin College, McCorkle College, Heidelberg College, Urbana University, Otterbein University, and Wilmington College. Of these, German Wallace, Denison, Marietta, and Urbana report laboratory facilities for students, but specify no work more advanced than elementary manipulation.

The scientific work of the German Wallace College is done in connection with Baldwin University. That of the Hebrew Union College is done in the University of Cincinnati.

Baldwin University, Farmers' College, Mt. Union College, Muskingum College, One Study University, Miami Valley College, Geneva College, Willoughby College, Wilberforce University, Ohio Central College, and Richmond College neglected to report. With the possible exception of Baldwin University, it is probable that none of these colleges undertake advanced scientific work. See the statistical tables for further details.

UNIVERSITY OF CINCINNATI.

F. W. Clarke, professor of chemistry and physics. Mechanics and mathematical physics are taught by the professors of mathematics, H. T. Eddy and E. W. Hyde.

Physics.—Optional in the classical course. Required in the freshman year of the scientific and engineering courses and elective afterwards. A full year's preparation in elementary physics is given by the Cincinnati high schools and is required for admission to this work in the university.

The regular course in physics covers two years, the freshmen and sophomores meeting together. Two lectures a week are delivered, one year upon heat and electricity, the second year upon sound and light. These two courses alternate, one being given one year and the other the next. For collateral reference, Atkinson's Ganot is used; but there are no set recitations. The students are obliged to take notes of the lectures and to submit them to the inspection of the professor.

Facilities are afforded for a limited amount of laboratory practice in physical measurements. The outfit of apparatus is moderately good, being better, in fact, for the laboratory than for the lecture room.

In the department of mathematics and engineering, the following physical work is done: The first year students in the scientific and engineering courses take mechanics, as a prescribed study, three times a week throughout the year. Text book, Todhunter's Mechanics for Beginners. In the engineering course, Rankine's Applied Mechanics is studied for one junior term and thermodynamics is given during one term of the senior year. There are also occasional elective and advanced courses in mathematical physics. For example, during the school year 1878–'79, a class under Professor Eddy studied Cumming's work on theoretical electricity.

Chemistry.—Optional in the classical course; required through the first year in the scientific and engineering courses. The Cincinnati high schools furnish a year's instruction in elementary chemistry, including laboratory practice; and this amount of chemical training is required for admission to university work in this department.

The full chemical course covers four years, of which the first is the minimum prescribed amount indicated above. Leaving out of account the accessory studies in mathematics, language, &c., taken by candidates for degrees, the course in chemistry for students who make this subject their special choice is as follows:

First year.—General inorganic and theoretical chemistry, two lectures a week throughout the year. The first term is devoted to theory, the second to the non-metals, and the third to the metallic elements and their compounds. Students take full notes, which are examined by the professor. Text books for collateral study, Remsen's Theoretical Chemistry and Roscoe. Qualitative analysis: Laboratory exercises at least five hours a week during the year. The usual ground is covered. A

certain amount of work is also done in making preparations and determining specific gravity.

Second year.—Quantitative analysis, especially of salts, definite alloys, and the easier minerals. Organic chemistry: A short course of lectures is delivered, based upon Armstrong's text book. But the greater part of the work consists of laboratory exercises, continuing throughout the year, and embracing practice in the derivation of compounds, the determination of boiling and melting points, fractional distillation, &c.

Third year.—Quantitative analysis continued, including work upon the more difficult minerals, organic combustions, and volumetric analysis. Organic chemistry: Laboratory practice continued.

Fourth year.—Quantitative analysis continued, chiefly in the direction of commercial products, such as soaps, bleaching powders, milk, &c. Assaying. Thesis work: Students who make chemistry their central study are required to submit to the faculty a thesis embodying the results of an original laboratory investigation. Throughout the entire course research work is kept in view and an effort is made to give even elementary students some exercises in the solution of unsolved problems.

The laboratory has accommodations for thirty students, giving each one a table with three drawers, double closet, and set of reagents. In addition to the main laboratory, there is a furnace room, assaying room, balance room, and store room. The outfit of chemicals and apparatus is very good, and a beginning has been made for a technological collection.

All laboratory students pay a fee of $5 a year to cover the wear and tear of apparatus. Breakage is also charged on individual supplies at the end of the year. Regular students in university courses are charged $5 a term for chemicals; special students pay $15. Special students who take assaying only, pay $5 a term. The laboratory is open daily, except Saturdays and Sundays, from 9 A. M. until 5 P. M. Special students, graduate students, and others are received and given every facility which the department can afford.

The university was opened in September, 1874. In the year following, the present laboratory was equipped. Since that time twelve short researches have been published from it, under the general title of "Laboratory notes from the University of Cincinnati."

OHIO STATE UNIVERSITY, AT COLUMBUS.

Physics.—Professor S. W. Robinson. Two terms of work in general physics are required of all candidates for degrees. There is afterwards an advanced course of two years, chiefly in laboratory work, for such as elect it. This course is as follows:

First year.—First term: Principles of physics and illustrated lectures. Second term: Physical laboratory, acoustics and optics. Third term: Physical laboratory, optics.

Second year.—First term: Physical laboratory, heat. Second term:

Physical laboratory, heat and electricity. Third term: Physical laboratory, electricity and magnetism.

The physical laboratory is unusually well provided with general apparatus and delicate instruments of precision. The work in it consists either of reviews of the experimental determinations of others or of original investigations. Students are trained both to obtain data and to work out results. The laboratory practice is carried on side by side with the study of advanced treatises.

Mechanics and thermodynamics are taught in the several engineering courses. Special students in physics are received.

Chemistry.—Professor S. A. Norton and several student assistants. Assaying is taught by the professor of mining and metallurgy.

All candidates for degrees are required to study chemistry for two consecutive terms. During this time, general chemistry, both inorganic and organic, is taught by text books and experimental lectures. Special attention is paid to the applications of chemistry to the useful arts.

After finishing this elementary work, those who so desire may take up the following two years' course in the laboratory:

First year.—First term: Qualitative analysis: reactions of single bases and acids, exercises in blowpipe and flame reactions. Second term: Qualitative analysis continued: determination of mixtures, blowpipe mineralogy, preparation of compounds. Third term: Quantitative analysis, stoichiometry.

Second year.—Quantitative analysis: special work applied to pharmacy, agriculture, manufactures, and the arts.

The quantitative work includes both gravimetric and volumetric analysis. Students work in the laboratory at least two and a half hours daily, and may spend five hours if they choose. The laboratory is well provided with apparatus and chemicals, and for assaying there is a full equipment of furnaces and material. A third year's course is offered to those who desire it.

But one original investigation is reported, namely, "A report on the ores of the Hocking Valley," by C. C. Howard.

The university was first opened in 1873. Chemistry and physics have been taught from the beginning. The physical laboratory was probably the first one established west of the seaboard.

OHIO WESLEYAN UNIVERSITY, AT DELAWARE.

W. O. Semans, professor of chemistry and physics.

Physics.—This study is wholly prescribed. Beginning with the third sophomore term, it is carried through a course of thirty weeks, with five weekly exercises of forty-five minutes each. The exercises consist of recitations, with experiments and occasional lectures. Text book, Atkinson's Ganot. There is no physical laboratory.

Chemistry.—The required course occurs in the sophomore year and covers twenty-five weeks, with five weekly exercises of forty-five minutes

each. This time is allotted to recitation work, experiments, and lectures, the latter numbering in all about thirty. Text book, Roscoe.

The optional course in laboratory practice follows the junior course of practical chemistry of Owens College somewhat closely. It includes preparative work and qualitative analysis. Optional courses are also offered in toxicology, urine analysis, and so on; but these are not largely attended. Determinative mineralogy is taught as an extra in connection with blowpipe analysis, but no allowance is made for this in the student's schedule of studies.

The laboratory was first opened in 1866 and has been extended from time to time since then. It contains sixteen working tables equipped with gas and water. There is also a good private laboratory for the professor.

WESTERN RESERVE COLLEGE, AT HUDSON.

Physics.—C. J. Smith, professor of mathematics, natural philosophy, and astronomy. The course of study, which is entirely required, consists of recitations four times a week for thirty-nine weeks, beginning with the junior year. Weekly experimental lectures are also given. Text book, Atkinson's Ganot.

Chemistry.—E. W. Morley, professor of natural history and chemistry. The study is begun in the third term of the junior year and is obligatory on all candidates for degrees. The course consists of recitations and of laboratory practice, with four or five exercises a week during twenty-four weeks. While lectures are not undervalued, they do not form a regular part of the course of instruction, for the time which would be used in delivering them and illustrating them is rather expended in securing the proper performance of experiments by the students themselves. Nichols's abridgment of Eliot and Storer's manual is used as a text book, on account of its availability both in the laboratory and the class room. Every student is required to perform all the experiments described in the lessons studied and to make brief clear notes of his work. Laboratory practice is continued in the first senior term, and in the last term of the same year those who so desire are permitted to study qualitative analysis. Some make a small beginning in quantitative analysis also. Something like a third of the senior class usually busy themselves with chemistry during this term. Some original researches have been published by Professor Morley, but no list of them is reported.

The laboratory has conveniences for a class of twenty-four in elementary chemistry and of twelve in qualitative analysis. There is also a good analytical laboratory for the professor, with a very complete laboratory for the analysis of gases; but these are private property.

OBERLIN COLLEGE, AT OBERLIN.

Physics.—Professor C. H. Churchill. The classes in the preparatory department study Avery's text book and see experiments performed.

The college classes take up Snell's Olmsted in the latter part of the sophomore year and study this treatise for two entire terms. They also hear ten or twelve experimental lectures. All studies after the freshman year are elective, but nearly all students take both chemistry and physics.

Chemistry.—Professor William K. Kedzie. In the first junior term inorganic chemistry is taught by lectures and daily laboratory practice. In the second term there are two lectures a week and laboratory work in organic chemistry and five hours a week in qualitative analysis. The seniors have instruction in blowpipe analysis five hours a week for one term. Although five hours a week is the time regularly allotted to laboratory practice, students are encouraged to do as much extra work as possible. Special students in quantitative analysis can enter the laboratory at any time by arrangement with the professor.

The rooms assigned to chemistry are as follows: a lecture room; a qualitative laboratory, with thirty work tables for wet analysis and twenty-four tables for blowpipe work; a quantitative laboratory, with eight tables; a balance room, and an office. The laboratory is supplied throughout with gas and water.

Both chemistry and physics have been taught at Oberlin since the opening of the college in 1834. The instruction in physics has been of about the same character throughout, except that the means for experimentation have largely increased. Chemistry was taught almost wholly by lectures. The first attempt at the introduction of experimental work among students was made by having the class supply themselves with material, perform their experiments in small laboratories of their own fitting up, and report results to the instructor. In September, 1878, the chemical department was reorganized upon a modern basis, the laboratories were equipped, and the course of instruction described above was adopted.

WITTENBERG COLLEGE, AT SPRINGFIELD.

Physics.—Taught to the junior class upon the basis of Snell's Olmsted.

Chemistry.—The course, which is wholly prescribed, consists of recitation work based upon Barker's text book, and laboratory practice in qualitative analysis. In the latter subject, students are required to become familiar with Eliot and Storer's text book. Extra laboratory work is encouraged, but there is little time for it.

WOOSTER UNIVERSITY, AT WOOSTER.

O. N. Stoddard, professor of the natural sciences. Natural philosophy is studied during the junior year and embraces mechanics, hydrodynamics, pneumatics, acoustics, electricity, magnetism, optics, physical geography, and meteorology. Heat and galvanic electricity are taught during the senior year in connection with chemistry. Chemistry is taught by a systematic course of experimental lectures, by recitations

from a text book, and by analytical work in the laboratory. The use of apparatus in the latter involves the students in no extra expense, but breakage is charged and chemicals are furnished at cost.

ANTIOCH COLLEGE, AT YELLOW SPRINGS.

Physics.—C. H. Chandler, professor of mathematics and physics. Taught from Avery's text book for twelve weeks in the middle preparatory year. In the college course one sophomore and two junior terms, one year in all, contain this study. In mechanics, Goodeve's book is studied, but in acoustics, optics, and heat no regular text book is employed. In electricity the general line of thought suggested by Fleeming Jenkin's work is followed. Lectures and practical work go together. For the latter there is some valuable apparatus, but not enough for a very extensive laboratory course. Prominence is given to the construction and extemporizing of apparatus by the students themselves.

Chemistry.—Taught by Professor E. W. Claypole, who also has charge of the natural sciences and French. Lectures and simple experiments are given in one term of the middle preparatory year. In the college proper, the seniors study chemistry for one term, having lectures and laboratory practice. Text books are used only for reference. The entire course is obligatory. More than half of the time assigned to chemistry is devoted to practical work.

Antioch College was opened in 1853, and these studies formed part of both the preparatory and undergraduate courses from the first. Horace Mann was the first president of the college, and under his administration elective courses of study were offered giving the sciences much greater prominence than in other colleges at that period.

INDIANA.

Reports were received, besides those of the institutions described below, from Bedford College, Franklin College, Hanover College, Hartsville University, Union Christian College, and Ridgeville College. Of these, Hanover College reports laboratory facilities for students.

Concordia College, Fort Wayne College, Smithson College, University of Notre Dame du Lac, and St. Meinrad's College neglected to report. See the statistical tables for further details.

INDIANA UNIVERSITY, AT BLOOMINGTON.

Physics.—Professor T. A. Wylie. Astronomy is taught by the same teacher. Instruction is given partly by experimental lectures and partly by recitations. Text book, Atkinson's Ganot. The junior class study mechanics for one term and acoustics and heat for another. The seniors have one term of instruction in optics. The second junior term in physics is optional. Electricity is also taught, but the time assigned to it is not reported. The exercises are daily.

Chemistry.—Professor T. C. Van Nuys, with an assistant and a ser-

vant or janitor. In the second and third terms of the sophomore year there is given a course of experimental lectures upon general inorganic and organic chemistry. No regular text book is used, but students are advised to own certain works for reference. This course is required of all candidates for degrees.

Laboratory work is optional, but both qualitative and quantitative analysis are taught, and may be continued through the junior and senior years. The course in qualitative analysis extends through about a year and a half, and includes a large amount of work with the blowpipe, the latter upon the basis of Plattner's manual. Fresenius is the author used in analytical chemistry. Provision is made for a laboratory course in organic chemistry, but as yet no students have taken it. Regular students who take laboratory electives are required to spend two hours a day in actual practice. For special students the laboratory is open from 8 A. M. to 12.20 P. M. and from 1.30 P. M. to 5 P. M.

The laboratories occupy two rooms, with a balance room adjoining. In one room there are places for thirty students to work with ease; in the other, there are tables for seven. In the cellar is a distilling apparatus and a hood for sulphuretted hydrogen. The laboratories are well provided with gas, water, hoods, reagents, and apparatus.

The institution was organized in 1828, and from the commencement these sciences have been taught. At first a single professor had charge of both physics and chemistry; but in 1867 the chair was divided, one teacher retaining physics and the other taking chemistry and natural science. In 1874 a regular professor of chemistry was appointed, the former incumbent retaining natural science.

WABASH COLLEGE, AT CRAWFORDSVILLE.

Physics.—J. L. Campbell, professor of natural philosophy and astronomy. Taught by recitations and experimental lectures throughout the junior year. Textbook, Atkinson's Ganot. Also taught from Wells's text book for one term in the English and normal course. There is a good outfit of physical apparatus.

Chemistry.—Professor H. R. Thomson. In the classical course, chemistry is taught from Barker's text book, with accompanying experimental lectures, during the first third of the senior year.

In the scientific course chemistry is studied throughout the sophomore year. The first term is spent upon Roscoe's text book, with lectures and laboratory practice. The second and third terms are mainly occupied with chemical analysis, except that in the third term lectures and recitations on organic chemistry take up part of the time. Provision is made for both qualitative and quantitative analysis. Breakage is charged, and a fee of five dollars a term covers the cost of the chemicals used.

Peck Hall, a building devoted to chemistry and physics, was completed in 1878. It is two stories high above the basement, and contains

two large lecture rooms, two general laboratories, six rooms for apparatus and supplies, two professors' rooms, a trustees' room, and five basement rooms for assaying, manufacture of gases, storage, &c.

INDIANA ASBURY UNIVERSITY, AT GREENCASTLE.

J. M. Mansfield, professor of natural sciences.

Physics.—Taught for two junior terms in the classical course and for three terms in the philosophical course. Also taught in the preparatory department. Lectures are given, with experiments, but no set text book is used; students are, however, encouraged to make extensive use of works of reference.

All students who take physics enter at once upon systematic laboratory practice. Most of the apparatus is upon tables in four commodious rooms, one a general laboratory, one a room for electricity, a third for spectroscopic and other optical work, and the fourth for screen projections. Special attention is paid to methods of exact experimentation, calculation, graphical representation, &c. Most of the juniors undertake special investigations, and in some cases design and construct their own apparatus. A large election in work is allowed. Those students who intend to become physicians study animal mechanics, using the methods of Marey, Helmholtz, Wundt, Houghton, and others. Engineers take mechanics, musicians study sound, and so on. In short, each student is encouraged to work in the line of his future profession, while at the same time getting a general knowledge of the whole field. At the date of reporting, fifty-four preparatory students and forty-one juniors were taking laboratory practice in physics.

Chemistry.—Required for one term of the freshman year in the philosophical course, optional for two sophomore terms. The same total amount is optional in the classical course.

In the laboratory, students begin at once upon qualitative analysis. As occasion requires, the professor gives them the symbols of the substances with which they are working, the laws of valence, reactions, &c., and notes are taken. Each student remembers as much as he can, experiments, refers to books in the library, and writes a full summary of the work accomplished.

As with physics, a free election is permitted in chemistry with reference to the future business or profession of the student. At the date of reporting there were ninety students at work in the chemical laboratory.

BUTLER UNIVERSITY, AT IRVINGTON.

Physics.—Taught by the professor of mathematics and astronomy, W. M. Thrasher. Instruction begins in the junior year and is given by lectures and recitations. Students in the classical and philosophical courses have physics for two terms; the scientific students, for four terms. The apparatus is not extensive, but is enough to illustrate the essential principles of the science. There is no physical laboratory.

Chemistry.—Taught for the present by the professor of natural history, O. P. Hay. Instruction begins in the junior year. The classical students take up chemistry for one term and have three recitations a week. Text book, Roscoe. In addition, the philosophical students have one term and the scientific students two terms in qualitative analysis. Text book, Crafts. Students who wish to spend more time upon chemistry may take up quantitative analysis.

The laboratory is fitted up with water and gas and can accommodate about twenty students working at once. The apparatus and chemicals are sufficient for ordinary experimental and analytical work. No researches are reported. Facilities are offered for special students in chemistry.

After the present year, chemistry and physics will probably be placed in charge of a special professor.

PURDUE UNIVERSITY, AT LAFAYETTE.

Harvey W. Wiley, professor of chemistry and physics.

Physics.—Required during the second and third sophomore terms. Instruction is given by experimental lectures upon mechanics, hydrostatics, pneumatics, and acoustics for one term, and upon heat, light, electricity, and magnetism for the second term. There are no regular text books, but students are encouraged to read standard works.

In the senior year there is an elective course of laboratory practice. The physical laboratory is not yet fully equipped, but it affords facilities for a year's work of two or three hours daily. This course was introduced in 1877. There is a good outfit of apparatus for illustrating experimental lectures.

Chemistry.—Required, with laboratory practice, two hours a day throughout the junior year. Inorganic chemistry occupies two-thirds of the time and organic chemistry one-third. No set text books are emplcyed. The course includes theoretical chemistry, the elements of synthetical chemistry, qualitative analysis, and crystallography. Students use the balance and apply the principles of stoichiometry from the first. Definite quantities of substances are used, and the product of each reaction is weighed or measured, the actual quantities thereof being compared with the theoretical.

There are also two years of elective study, arranged as follows:

First year (second year from the beginning).—First term: Lectures on qualitative analysis, five hours a week; laboratory practice, ten hours a week. Second term: Lectures on qualitative analysis continued; soils, minerals, and fertilizers; principles of quantitative analysis; instruction five hours, laboratory work ten hours, a week. Third term: Quantitative analysis continued; general review of principles of analysis; time allotted as before.

Second year (third from the beginning).—Mineralogy, descriptive, mathematical, and determinative; metallurgy and assaying; organic

chemistry, lectures, recitations, and laboratory work. Special reference is made to technical applications. Students taking this year's course are expected to spend from six to eight hours a day in actual laboratory practice.

MOORE'S HILL COLLEGE, AT MOORE'S HILL.

O. P. Jenkins, professor of natural science.

Physics.—Taught for one term in the preparatory department and for two terms in the junior year. Text books, Quackenbos and Silliman.

Chemistry.—Begun in the sophomore year. One term is given to general chemistry, taught from Eliot and Storer's text book. A second term is devoted to qualitative analysis. Throughout both terms daily work in the laboratory is required. This course is entirely prescribed.

These studies were introduced into the college at its foundation, in 1857. Qualitative analysis began to be taught here in 1877.

EARLHAM COLLEGE, AT RICHMOND.

Physics.—In the preparatory course the students use an elementary text book. The seniors are required to master Silliman's Physics.

Chemistry.—The freshmen have four or five exercises a week for twenty-three weeks. They study Roscoe's Elementary Chemistry and assist the teacher in performing the experiments. The sophomores in the scientific course have instruction for fifteen weeks in qualitative analysis. Classical students occasionally take the latter as an elective. Qualitative analysis has been taught in the college since 1861.

ILLINOIS.

Reports were received, in addition to those of the institutions described in the text, from the Illinois Wesleyan University, Carthage College, Eureka College, Lombard University, Illinois College, Lincoln University, Northwestern College (at Naperville), and Augustana College. Of these, Lombard and Lincoln Universities and Northwestern College report laboratory work by students, apparently of an elementary character. All necessary details are given in the statistical tables.

Abingdon College, Hedding College, St. Viateur's College, Blackburn University, Rock River University, Ewing College, Knox College, Illinois Agricultural College, Swedish-American Ansgari College, McKendree College, Evangelisch-Lutherisches Collegium, Monmouth College, St. Joseph's College, Shurtleff College, Westfield College, and Wheaton College neglected to report. Such details as could be gleaned from catalogues are given in the tables.

UNIVERSITY OF CHICAGO.

Physics.—Taught by the professor of mathematics. An elementary course is given in the preparatory department and is required for admission to college. This course occupies twelve weeks. Classical students

take up the study of Snell's Olmsted in the sophomore year and devote twenty-seven weeks to it. In addition to the above, scientific and philosophical students are required to take a course of fifteen weeks in experimental physics.

Chemistry.—Professor C. G. Wheeler. Students in regular college courses are required to study chemistry from twelve to fifteen weeks. No laboratory practice is required. There is an optional course, however, in analytical chemistry. The chemical laboratory can accommodate six students at a time, and there is sufficient apparatus to fully illustrate the subject of inorganic chemistry before the classes. No facilities are offered for post graduate work. The laboratory fee for regular students is one dollar a term; for special students in chemistry, thirty-five dollars.

ST. IGNATIUS COLLEGE, AT CHICAGO.

Physics.—Required in the three highest college classes and in the scientific course; optional in the highest class of the commercial department. One year is given to the study of mechanics, hydrostatics, and pneumatics, a second to electricity and magnetism, and a third to acoustics and optics. Text book, Deschanel.

Chemistry.—Required and optional as with physics. One year is given to elementary chemistry, a second to analysis, and a third to organic chemistry and analysis continued. Laboratory work is required twice a week for two or three hours at a time, and extra practice on the part of students is encouraged.

The laboratory occupies a hall 50 by 25 feet and is fitted up with the usual work tables, gas, water, &c.

The college was opened in 1870, and these studies were introduced in the session of 1873–'74.

NORTHWESTERN UNIVERSITY, AT EVANSTON.

H. S. Carhart, professor of physics and chemistry. Professor Carhart also teaches astronomy. He is aided by one instructor.

Physics.—Elementary physics is taught in the preparatory school and is required for admission to college. All students in regular courses receive three terms of instruction in physics, beginning with the second junior term. The teaching is by text book recitations and experimental lectures. There are five exercises a week. One term is devoted to mechanics, one to sound and light, and the third to electricity, magnetism, and heat. Heat is taught by lectures exclusively, of which there are about fifteen.

There is a valuable collection of apparatus for illustration, but no physical laboratory. Nearly three hundred experiments have been performed before the classes in a single year.

Chemistry.—Begun by the scientific students in the sophomore year; by other students, as juniors. In all the courses one term in general chemistry is required. Instruction is given by text book and lectures,

Roscoe's Elementary Chemistry being the basis at present. Students in the scientific course are required to spend two terms in the laboratory studying qualitative analysis. In the other courses this laboratory work is optional. General chemistry occupies five hours a week, and analytical chemistry from three to five. Extra work is permitted.

The laboratory has desks for twenty students. Gas, water, and the usual reagents are supplied. About the first ten analyses are of bases only, from two to six in each mixture. Subsequent analyses are for both bases and acids. A few students pursue the study far enough to do some quantitative work. There is no demand for post-graduate instruction.

LAKE FOREST UNIVERSITY, AT LAKE FOREST.

Le Roy F. Griffin, professor of natural sciences.

Physics.—This study is wholly obligatory upon students in all courses. Instruction is given during the junior year, and covers altogether one hundred and sixty hours. Text book, Atkinson's Ganot.

Chemistry.—The classical students have twenty-five lectures upon general chemistry, and about the same number of laboratory exercises. This is in the senior year. Scientific students have also three years of instruction in chemical analysis.

ILLINOIS INDUSTRIAL UNIVERSITY, AT URBANA.

Physics.—Selim H. Peabody, professor of mechanical engineering and physics; Ira O. Baker, assistant. Elementary physics is required for admission to all regular courses except the classical. The study is also prescribed in all courses for two junior terms. Text book, Atkinson's Ganot. Instruction in physics is given under the following headings: First, recitations, five a week. Second, practice in the physical laboratory one day each week, in which the student applies the instruments to testing the principles taught. Third, illustrative experiments once a week, in which the most costly apparatus is used before the class for such demonstrations as are difficult to perform and which are most effective when prepared for an audience. Fourth, higher physical experiments by advanced classes, consisting either of researches or of reviews of the work of others.

The department is amply provided with apparatus for use in the lecture room, and has an extensive physical laboratory. Analytical mechanics and thermodynamics are taught in the engineering courses.

Chemistry.—Professor, H. A. Weber; M. A. Scovell, instructor in agricultural chemistry; also three laboratory assistants. This university is subdivided into eleven "schools," in which very different amounts of chemical instruction are given.

In the schools of agriculture and horticulture, chemistry is taught throughout the freshman year and agricultural chemistry during two sophomore terms. The latter is pursued in connection with laboratory practice in the analysis of soils, fertilizers, foods, &c. The school of

architecture has but one term of chemistry, with laboratory practice, in the junior year, while the schools of civil and mechanical engineering have double this amount. Students in mining engineering take chemistry, with laboratory practice, for two sophomore terms, and continue the laboratory work afterwards through two junior terms and the entire senior year. This laboratory practice covers qualitative and quantitative analysis, with assaying and blowpipe work, and is arranged with special reference to the needs of miners and metallurgists. In the schools of natural history and domestic science, chemical instruction is given through the freshman year. In the two specially linguistic schools it is required for one junior term, but the school of English and modern languages offers two additional terms as electives. There is also a school of chemistry, in which a regular four years' course of instruction is provided. In this course text book recitations upon the principles of chemistry and chemical physics occupy six weeks of the first term. Through the remainder of the first year recitations alternate with laboratory practice. During the next three years each student is expected to work two hours daily in the laboratory, five days in the week. In order to graduate he must make an original investigation and present a thesis. Students who pursue chemistry incidentally to other courses work two consecutive hours daily in the laboratory during as many terms as their special "school" may require. The full course for a degree in the school of chemistry is as follows:

First year.—First term: Trigonometry, advanced geometry, British authors or French, chemistry with laboratory practice (the latter in qualitative analysis). Second term: Analytical geometry, American authors or French, chemistry, and qualitative analysis completed. Third term: Calculus or free hand drawing, rhetoric, French (optional), organic chemistry, and quantitative analysis.

Second year.—First term: Physiology or botany, German, quantitative analysis. Second term: Zoölogy or botany, German, volumetric analysis, alkalimetry and acidimetry, analysis of corn or other grain. Third term: Zoölogy, German, preparation of salts, acids, &c., electroplating.

Third year.—First term: Mineralogy, German, ultimate organic analysis, analysis of urine. Second term: Physics, German, blowpipe analysis and determination of minerals; assaying, both dry and humid, of gold, silver, and lead ores. Third term: Physics, German, photography, including the preparation of photographic chemicals.

Fourth year.—First term: Mental science, meteorology and physical geography, gas analysis, analysis of mineral waters. Second term: Constitutional history, logic, toxicology, including the microchemistry of poisons. Third term: Political economy, geology, original research, and thesis.

The purely chemical portions of this course are somewhat variable, in order to accommodate the needs of students who intend to become

pharmacists, agriculturists, metallurgists, &c. The only "original researches" thus far reported consist of analyses of local soils, coals, vegetables, and so on. The largest individual paper is one on the "Coals of Illinois," by William D. Rudy.

The building occupied by the chemical department is four stories high, and covers an area seventy-five by one hundred and twenty feet. It was erected in 1878 at a cost of $40,000. The basement is twelve feet high, and contains a boiler room, hot air chamber, coal cellar, mill room for storing and crushing ores, a room for the manufacture of chemicals and pharmaceutical preparations, and a furnace room for assaying and metallurgical work. The latter is provided with a large smelting furnace, a forge, and an assay furnace; and the blast is produced by means of a Sturtevant blower. The first story is fourteen feet high, and contains a lecture room, two clothes rooms, a store room, and the qualitative laboratory. The latter will accommodate 152 students when completed, and now has desks for 104. Each desk has gas, water, and an evaporating hood. The second story is fourteen feet high. It contains a small lecture room with mineralogical cabinet and furnace models for illustrating metallurgy, a laboratory for agricultural chemistry, a store room, a balance room, a room for pharmacy, a private laboratory for the instructors, a room for gas analysis, and the main quantitative laboratory. The latter now contains 48 desks, and can hold 152. The gas analysis room has but one outside wall, and is entirely cut off from the system of heating and ventilating in order to avoid fluctuations of temperature. The room for pharmacy is fitted up like a drugstore. On the mansard floor provision has been made for laboratory work in photography.

MICHIGAN.

Reports have been received, not only from the institutions described below, but also from Battle Creek College, Grand Traverse College, and Kalamazoo College. See the statistical tables for further details.

Albion College, Hillsdale College, Hope College, and Olivet College failed to report, but their catalogues have been consulted.

ADRIAN COLLEGE, AT ADRIAN.

I. W. McKeever, professor of natural science.

Physics.—Studied from Norton's "Elements" for one term in the preparatory school. In the college the juniors study Snell's Olmsted throughout the year, three hours a week. Instruction is accompanied by lectures and experiments. Although laboratory work is not a requirement, students are encouraged to engage in it and are given such assistance as will enable them to demonstrate experimentally for themselves the principles underlying the science.

Chemistry.—Taught in the senior year. Inorganic chemistry is studied for one term, with recitations and lectures. In the second term a short

course upon organic chemistry is given, and the student also begins to work in the laboratory. Qualitative analysis is studied during the second and third terms. Before entering upon the study of chemistry, the preceding course in physics must have been pursued.

Both studies have been taught in the college since its foundation. Analytical chemistry has been taught only for about six years.

UNIVERSITY OF MICHIGAN, AT ANN ARBOR.

In this institution each student may elect his studies and pursue them in any order he may choose; but if he is a candidate for a degree he must at some time take all the subjects which are "required" for the degree he seeks.

Physics.—Professor Charles K. Wead. Candidates for the degree of bachelor of science are required to pass an entrance examination in Norton's Natural Philosophy or an equivalent.

The following courses of instruction in physics are now offered: In the first semester, (1) experimental physics, two lectures and one recitation a week; (2) experimental physics, two lectures and three recitations a week—Deschanel's text book; (7) theoretical physics, two exercises a week; (8) physical problems, one exercise a week. In the second semester, (3) work in the physical laboratory, five days a week; (4) work in the physical laboratory, three days a week; (5) advanced acoustics, one lecture a week; (6) special work with students intending to become teachers. The first and second courses relate to mechanics, acoustics, and optics, and have about fifty students in each. In the laboratory about fifteen students are usually engaged. Heat and electricity are taught by the professor of general chemistry. The "required" courses are as follows: For B. A. degree, course 1; for B. L. degree, course 1; for B. S. degree or for degrees in civil or mining engineering, course 2. The other courses are on the list of electives.

The physical laboratory is well provided with apparatus for measurements in most of the important departments of the science. The laboratory courses may be taken during the second semester by all students who are familiar with the general principles of experimental physics. Students who are sufficiently advanced to work independently may take laboratory practice during the first semester. Pickering's Physical Manipulation is used as a text book, and facilities are offered the pupil to carry out such of his own ideas as seem to be practicable. Lectures are given in connection with the work and reports are made by each student.

Students desiring to become familiar with lecture room apparatus in order to fit themselves for teaching, or for other purposes, can be accommodated to a considerable extent. More attention will hereafter be given to such students in connection with the laboratory work.

From year to year the subjects treated in the advanced courses will be varied; and it is hoped that before long a higher course of lectures

may be given upon experimental physics, going over the whole ground. This course would be open only to those who had already considerable familiarity with the general subject. There are no extra charges for any of the work in physics.

Chemistry.—Candidates for the B. S. degree are required to pass an entrance examination in Nichols's abridgment of Eliot and Storer's manual or its equivalent. The teaching force in chemistry is as follows: Albert B. Prescott, professor of organic and applied chemistry and pharmacy; John W. Langley, professor of general chemistry, in charge of metallurgy; assistant professor, P. B. Rose; instructors, O. C. Johnson, B. W. Cheever, V. C. Vaughan, and D. A. Joy; also two student assistants.

In the department of general chemistry there is a course of lectures during one semester to medical and dental students; subject, chemical physics and general and theoretical chemistry. For students in the literary department elective courses are offered as follows:

(1) A course of lectures, three a week for one half year, with experiments, upon the subjects of heat, electricity, and chemistry. (2) A course of lectures as above, with mathematical and text book work, five times a week during one half year. (3) A course of lectures, twice a week for half a year, on the kinetic theory of gases and on chemical philosophy. (4) Laboratory methods of study; each student has a desk and apparatus and works out experimentally such general theorems as "substitution," "equivalents," "molecular weights," "combining volumes," &c., three times a week for half a year, two hours each time. (5) Similar to 4, but includes in addition experimental work on a large or lecture room scale, five times a week.

General physics must precede any of these courses, and numbers 1 and 2 must be taken before 3, 4, or 5. Course 1 is elementary, and is the minimum under which candidates for the B. A. degree can pass. Course 2 is intended for scientific students and civil engineers. Course 3 is for professional chemists and for post graduate students. Courses 4 and 5 are supplementary to 1 and 2.

For post graduate work, leading to the degrees of M. S. and PH. D., no regular course is prescribed. It consists of original investigations in the laboratory and in a critical study of some one of the fundamental theories of chemistry. The number of students in professional schools attending the lectures to medical students is at present about 450.

The laboratory of analytical and applied chemistry provides instruction for students in the academic department, in the schools of medicine and of pharmacy, and in the dental college. In the department of literature and science, chemical laboratory work is wholly elective, and is organized as follows: (1) Qualitative analysis, five recitations and five laboratory exercises a week, for one or one and a half semesters; (5) quantitative analysis, twice a week in the class room, and five times a week in the laboratory, for one semester; (6) proximate organic analysis, daily for two months, to make (with a course of lectures on organic

chemistry) an elective in the last named subject, for one semester; (7) ultimate organic analysis, five times a week in the laboratory; (8) physiological chemistry, five times a week, including laboratory work and lectures, for one semester; (9) assaying of ores, laboratory work, and lectures, daily, for two months; (10) blowpipe analysis, daily, for two months; (11) original investigations, five times a week, laboratory work, and reading.

Laboratory practice is from two to three hours daily. Course 1 or 2 in general chemistry must precede any course in analytical chemistry. Courses 8 and 10 are open to those who have completed course 1, and courses 7, 9, and 11 to those who have taken courses 1 and 5. The average annual number of academic students in the laboratory for the past five years is $38\frac{3}{5}$. About two-thirds of them take as much as two semesters of work and one-fourth to one-third take four semesters. At present they cannot elect to begin analytical chemistry with less time than one semester, having daily classroom exercises and daily laboratory practice.

In nearly all the classes, teaching in the class room accompanies laboratory practice, so that the work of the student at his table for the day has been directed in the last lecture or recitation and is to be explained at his next class exercise. Laboratory practice without didactic study is here held to be as futile as didactic study without laboratory practice.

The lecture room in chemical physics and general chemistry will accommodate nearly five hundred students, and is arranged with elevated seats having special reference to experimental illustration. The instruction in metallurgy is supplemented by a collection of furnace models, constructed upon an accurate scale.

The laboratory of analytical and applied chemistry occupies a ground space of 15,000 square feet and contains six work rooms devoted to different branches of experimental study, furnishing in all 175 student's tables. Each table is supplied with gas, water, and washbasin and waste pipe, and with suitable apparatus. Each student has an average area of 55 square feet and an air space of 800 cubic feet. The laboratory is furnished with sand, water, and steam baths, drying ovens, and exhaust connections for filtration. In the balance room, accurate balances are separately assigned to the students in quantitative work, and microscopes are provided in the microscopic room for those who require these instruments. The general furnace room (30 by 100 feet) is supplied with assay, blast, and other metallurgic furnaces and with apparatus for ultimate organic analysis. The standard works of reference for chemistry and the allied sciences are kept accessible to the students. The laboratory rooms are well ventilated by Sturtevant fan ventilators.

The chemicals and apparatus actually consumed in the individual work of the student must be paid for by him. On entering the laboratory he makes a deposit of ten dollars, and a set of apparatus is inventoried to him. From time to time additional supplies are furnished, and

an account is kept. On leaving the laboratory he is credited with what remains unconsumed and the balance is struck. All supplies are furnished at the printed price current of the New York dealers. Experience shows that the average laboratory expenses are about one dollar and twenty cents a week.

The original researches published from this laboratory have mainly been in the line of pharmaceutical or medical chemistry. No list of them has been submitted.

As the plan of teaching qualitative analysis at this university varies somewhat from the usual routine, the following statement of it has been prepared by Instructor O. C. Johnson. The course consists of six months in laboratory work, four hours daily, with daily recitations. Before beginning actual analysis the student studies solubilities classified according to the acids. He finds by experiment what solutions of metals are precipitated by fixed alkalies, ammonic hydrate, sulphuric, hydrochloric, hydrosulphuric, phosphoric, and sulphurous acids, ammonium sulphide, potassium bromide, potassium iodide, sodium phosphate, sodium sulphite, &c., until all the acids of more common occurrence have been studied and the corresponding equations learned. He then begins the analysis of known material, giving in class orally the corresponding equations. This is followed by the analysis of unknown material. Fifty mixtures are analyzed, each containing several salts, thirty being solids and twenty solutions. These are made to illustrate the most important points of analysis, with special reference to the principles of oxidation and reduction.

Solutions are next given for which the ordinary methods of analysis make no provision; such, for instance, as mixtures in which metals are precipitated in groups to which they do not belong. Two or three examples will illustrate.

No. 1.	No. 2.	No. 3.
$BaCl_2$	$Sr(NO_3)_2$	$CuSO_4$
NH_4CNS	$NaCNS$	NH_4OH
$NaClO_3$	$NaNO_2$	KIO_3
		Na_2SO_3

On addition of hydrochloric acid to these solutions barium sulphate is thrown down from the first, strontium sulphate from the second, and cuprous iodide from the third. Thus, by taking advantage of the oxidizing action of the suddenly liberated acids, nearly all of the metals may be precipitated in the hydrochloric acid group or carried to some group in which they do not belong. The student works ten of these mixtures before reporting; and, if necessary, an analysis is repeated until correct results are reached.

Three hundred problems are also given. For example: How may Fe_2Cl_6 be made from $FeSO_4$ and KCl? That is, the Fe for the Fe_2Cl_6 is to be derived from the $FeSO_4$, and the Cl from the KCl; the final product to be free from all impurities. Only about one-tenth of these problems

are experimentally performed. For the remainder the student gives methods, quoting authority for each step from the books and journals to which he has access. In some problems the cheapest method is required; others are of theoretical interest only.

MICHIGAN STATE AGRICULTURAL COLLEGE, AT LANSING.

Physics.—Peck's mechanics is studied through one sophomore and one junior term. Miller's Chemical Physics is used through the second junior term. No fuller statement concerning physics is reported.

Chemistry.—Professor R. C. Kedzie and one assistant. Elementary chemistry is begun in the third freshman term and continued into the sophomore year. The course covers twenty-five weeks of daily lectures, and the students use Roscoe's work for reference.

In the second sophomore term there are lectures upon organic chemistry and twelve weeks in blowpipe and volumetric analysis of one hour's practice daily. In the third term, for twelve weeks, the sophomores have qualitative analysis three hours a day, using Professor Kedzie's Handbook. The juniors have one term of twelve weeks in agricultural chemistry, with daily lectures, and one term, as already indicated, in chemical physics. The total amount of time given to chemistry and physics, including meteorology, is ninety-nine weeks. Post graduate students are allowed to pursue quantitative analysis to any extent they desire, but no regular post graduate course of study has been established.

The chemical laboratory includes a lecture room for eighty students, an analytical room with tables for forty-eight students, a professor's laboratory and study, and rooms for higher researches. Professor Kedzie reports investigations into electrical conduction, the "magnetic wells" of Michigan, the food value of different varieties of wheat, analyses of Indian corn, and analyses of soils of Michigan.

WISCONSIN.

Reports were sent in by the institutions described below, and also by Lawrence University, St. John's College, and Milton College. Additional details are given in the statistical tables.

Galesville University, at Galesville, and Northwestern University, at Watertown, failed to report.

BELOIT COLLEGE, AT BELOIT.

In the preparatory school, instruction is given in the elements of both chemistry and physics. Candidates for admission to the collegiate philosophical course are required to pass an entrance examination in both subjects.

Physics.—One exercise daily through two-thirds of the junior year. There are recitations based upon Atkinson's Ganot, and experimental

lectures. One professor has charge of this subject, and also of mathematics and astronomy.

Chemistry.—In the classical course, chemistry has a place daily for two-thirds of the sophomore year. In the philosophical course it is studied through the whole year. Instruction is given by lectures, text book recitations, and laboratory practice in qualitative analysis. The latter is required of all regular students, but those in the philosophical course do more than the others.

Both sciences have been taught in this college since its opening in 1847. Regular laboratory work in chemistry was introduced in 1866.

UNIVERSITY OF WISCONSIN, AT MADISON.

Physics.—John E. Davies, professor of physics. Mechanics is taught in the department of civil engineering. The elements of physics are required for admission to the general science and modern classical courses.

After 1881 it will no longer be required for the latter. In the "college of letters" physics is a prescribed study during the first third of the junior year and is elective afterwards. In the science and technological courses, more work is done.

The instruction is given by lectures and experiments during four terms, beginning with the first term of the junior year. Students whose average standing does not fall below 85 may take extra studies in physics. These consist of a course of practical training in the use of the spectroscope, and also of electrical and other measurements, going over about the ground covered by Pickering's Physical Manipulations. As the work to be done presupposes a good knowledge of theory, the following works are simultaneously studied: Chauvenet's Combination of Observations and Method of Least Squares; Airy's treatises on Light and Sound; Jenkin's and Maxwell's treatises on Electricity and Magnetism; Boole's Differential Equations; Todhunter's Spherical Harmonics. The theory of determinants is studied as far as it may be needed for the comprehension of the above works. The physical laboratory is comparatively new and is not yet very fully equipped, although the rooms are tolerably well adapted to their purposes. The lecture apparatus in physics is very fair.

Attached to the department of physics is the magnetic observatory. While it is primarily intended to further the science of terrestrial magnetism, the theory and mechanism of the instruments are explained to the students in practical physics; and opportunity is given each year for observing the method of determining the absolute values of the magnetic elements at Madison according to the methods of the United States Coast Survey.

Chemistry.—Professor W. W. Daniells and one laboratory assistant. R. D. Irving, professor of geology, mining, and metallurgy, teaches assaying. Generally begun in the junior year. In the engineering courses chemistry is taken by the sophomores. Two courses in chemistry are

provided, a long and a short course. Students may elect which of the two they will follow, but one must be taken. The short course consists of twelve weeks' instruction, principally by lectures, in inorganic and organic chemistry. It is intended only to give an outline of the science, with some knowledge of the general principles governing chemical changes. Text book, Roscoe.

The long course consists of a daily exercise throughout the year, and may be continued two years at option. Instruction in inorganic chemistry is given by lectures, with free use of the text book (Thorpe), and by laboratory practice during the fall term. The lectures are illustrated by experiments. During the spring term a course of lectures is given on chemical philosophy and the chemistry of the carbon compounds. Qualitative analysis is begun upon the completion of the course in inorganic chemistry. The course includes the analysis of fifty solid substances, containing not more than one base and one acid each, and of forty complex substances, most of which are ores, minerals, or bodies used in the arts. Laboratory work is accompanied by frequent lectures and reviews. Exercises in stoichiometry and chemical problems are required throughout the year.

Quantitative analysis is begun after the course in qualitative work has been completed. Each student makes duplicate analyses of every substance. Volumetric analysis is also taught and volumetric methods are frequently used in the laboratory. Students intending to become physicians, after finishing the qualitative course, will be given special facilities for urine analysis, the detection of poisons, and the analysis of foods, drugs, &c. To those desiring to become teachers of science and who have taken the course in qualitative analysis, an advanced course in experimental chemistry will be given.

Both the qualitative and quantitative laboratories are large, well ventilated and well lighted, supplied with gas, water, and all the necessary fixtures. Each student is assigned a convenient table, shelves, drawers, and cupboard, and is supplied with a complete outfit of apparatus and reagents. Laboratory students make deposits of from \$5 to \$30 to cover the cost of chemicals and materials. The amount of the deposit not used is returned at the close of the term.

There are also laboratories for mineralogy and assaying, in charge of Professor Irving. In connection with determinative mineralogy an extended course in blowpipe analysis is given. Assaying is taught in the junior spring term to students of the courses in metallurgy and mining engineering and to such others as may so elect. The course includes about ten lectures upon the theory and practice of assaying, the remainder of the time being given to laboratory work. The whole number of assays made by each student is about one hundred, chiefly of gold and silver ores. The assay laboratory has tables for twenty students and is provided with six crucible furnaces, two roasting furnaces,

two large muffle furnaces, a Blake crusher, bullion rolls, bullion assay apparatus, &c.

Research is encouraged, but it is found practically impossible to retain students sufficiently long to adequately prepare them for such work. They generally hasten to get into some work that will afford a surer livelihood. Professor Daniells reports for his own part analyses of minerals and rocks made for the State Geological Survey, a paper upon catlinite, and another upon silicates of iron and lime in Milwaukee white brick.

Laboratory instruction in chemistry began here in 1868. It was at first wholly optional, but became a part of the curriculum in 1872.

RACINE COLLEGE, AT RACINE.

Physics.—Rev. F. S. Luther, professor of mathematics and physics. The junior class meet the professor three times a week throughout the year. Text book, Snell's Olmsted. The subjects of electricity and heat are supplemented by lectures and experiments. Chemical physics (light, &c.) is required for admission to the scientific school.

Chemistry.—R. C. Hindley. In the school of letters the juniors have three hours a week in Norton's text book and lectures upon organic chemistry. In the school of science four years of chemical instruction are given, as follows: The freshmen work and recite three hours a week in Eliot and Storer's text book and Caldwell and Breneman's Chemical Practice, and take notes of lectures on organic chemistry. After this year elementary chemistry will be required for admission. Three hours a week of extra laboratory practice are allowed, and students are encouraged to make use of the privilege. The sophomores have qualitative analysis, Fresenius, three times a week, and are permitted extra work for three hours more. The juniors, four hours a week with the privilege of three more, study determinative mineralogy. They also begin quantitative analysis, which, with assaying, is continued through the senior year. Three hours a week are required, and as much extra work as may be desired is allowed. There is, as yet, no post-graduate instruction.

The college was incorporated in 1852. Elementary chemistry and physics were taught the year following. The fuller course in chemistry began in 1866.

RIPON COLLEGE, AT RIPON.

A. H. Sabin, professor of chemistry and natural science.

Physics.—Taught for one term in the preparatory school. Text book, Norton. In the college course the juniors recite for two terms from Atkinson's Ganot, mechanics having been previously taught. There is no physical laboratory.

Chemistry.—The sophomores of the scientific course and the juniors of the classical course study Eliot and Storer's text book, having lectures also one term. The sophomores then have two terms and the juniors

one term of laboratory practice in qualitative analysis, working three hours a day. There is a good chemical laboratory for thirty-two students. It is arranged especially for qualitative work, but has some facilities for quantitative analysis. Laboratory practice was introduced into the college in 1876.

MINNESOTA.

St. John's College also reported. See the statistical tables.
Macalester College and Augsburg Seminary failed to report.

UNIVERSITY OF MINNESOTA, AT MINNEAPOLIS.

Physics.—L. W. Peck, assistant professor in charge of physics. Elementary natural philosophy is required for admission to the "scientific" and "modern" courses.

In the scientific course, physics is taught for three terms, namely, one term each in the subfreshman, freshman, and sophomore years. The classical and "modern" students have one term in the freshman class assigned to the general subject, and also spend two hours a week upon mechanics during the middle sophomore term. Atkinson's Ganot and Peck's Mechanics are the text books. In addition to this prescribed work there is an advanced elective course of practice in the physical laboratory. In connection with the latter, a small room has been set apart for a lathe and workbench, and students are encouraged to construct models and apparatus.

Chemistry.—Professor S. F. Peckham; F. C. Bowman, assistant. Begun in the freshman year. One term of general chemistry is required in all regular courses. In addition, the scientific students are obliged to take one term in applied chemistry and one term in chemical analysis. A year of analytical chemistry may be taken as an elective in the classical and modern courses and two years in the scientific course. In the College of Agriculture the regular scientific course is followed up to the junior year; and throughout this year agricultural chemistry, including the analysis of soils, fertilizers, and food, is required. Special students are received.

Instruction in chemistry, apart from the laboratory work, is given by lectures, with Barker's text book for reference. In addition to the ordinary drill in chemical theory and the properties of the elements, eight or ten lectures are devoted to the historical developmentof chemical theories from the period of the alchemists down to the present time. As an examination upon this portion of the work the students are required to write an essay upon the alchemists and on dualism. Results have proved these lectures to be of great assistance to students in gaining an intelligent idea of chemical philosophy.

A course of one year has been arranged for optional work by students who intend to study medicine. The first term is spent upon Appleton's Qualitative Analysis and the second and third terms upon Odling's

Practical Chemistry. In the second term special attention is paid to toxicology, and in the third term animal chemistry, including the examination of urine, is taken up.

The chemical laboratory occupies five rooms: (1) the main students' laboratory, 22 by 45 feet, with accommodations for 64 workers classed in two sections or "reliefs;" (2) the quantitative laboratory, 22 by 30 feet; (3) the apparatus room; (4) the professor's private laboratory; (5) a room in the basement fitted up for assaying and furnace work. A good beginning has been made towards a museum to illustrate chemical technology.

Laboratory expenses for students are low, not exceeding for chemicals and apparatus $10 a term. The value of apparatus given out is covered by a deposit of $10 made at the beginning of the term. From this, at the end of the term, the necessary charges are deducted.

CARLETON COLLEGE, AT NORTHFIELD.

L. B. Sperry, professor of physical science.

Physics.—Taught from Norton's text book, one term in the senior preparatory year. Also from Snell's Olmsted, one term in the college course.

Chemistry.—Begun in the freshman year. One term is given to elementary text book work, one to qualitative analysis in the laboratory, and one to molecular physics, nomenclature, and theory. Classical students are required to do six weeks of laboratory work, and scientific students twelve weeks.

IOWA.

Reports were received from the institutions described below and from Amity College, Griswold College, the Norwegian Luther College, University of Des Moines, Parsons College, Upper Iowa University, and Humboldt College. Details are given in the statistical tables.

Algona College, Simpson Centenary College, German College, Penn College, Central University of Iowa, and Western College did not report.

IOWA STATE AGRICULTURAL COLLEGE, AT AMES.

Physics.— Professor J. K. Macomber. Professor Macomber also gives instruction in geology. Physics is required through the junior and sophomore years. In the first sophomore term mechanics is studied two hours a week and in the second term sound and light three times weekly. The juniors take heat in the first term and begin electricity, with three exercises a week. In the second term, twice weekly, they finish electricity and hear a course of lectures on the more prominent recent discoveries and generalizations of physics. In the "ladies' course in science," the second junior term of physics is optional. Instruction is given by lectures and recitations. Text book, Atkinson's Ganot.

In the senior year there is a special optional course in physics. One

of the requirements for entering upon it will be proficiency in mathematics, and it is desirable that analytical geometry shall have been studied. The course includes the study of methods of physical investigation and the principles of scientific research. Practice in the laboratory is required two afternoons each week. Post-graduate courses are also offered.

The collection of physical apparatus is large and increasing every year. Excellent rooms are fitted up for the physical cabinet and provided with suitable experimental tables.

Chemistry.—Professor T. E. Pope; J. S. Lee, assistant professor. Required through the sophomore year in all courses; also through the junior and senior years in the agricultural course, but partly replaceable by electives. In the ladies' course there is also a requirement in the second junior term of one hour a week in domestic chemistry. In the latter, such subjects as bread making, cooking in general, the composition of foods, the antidotes for the commoner poisons, adulterations and their detection, &c., are treated of. There are facilities for post graduate courses, in addition to the foregoing. The general course in chemistry is as follows:

Sophomore year.—First term: General chemistry, three times a week. Text book, Barker. Instruction is given largely by lectures. There are also two afternoons a week in the laboratory, in which the student becomes familiar with various chemicals and the manipulation of apparatus. Second term: Qualitative analysis, twice a week in the lecture room and two afternoons a week in the laboratory. About forty substances are analyzed. During this term instruction is also given in chemical problems.

Junior year.—First term: Quantitative analysis, four afternoons a week in the laboratory; Caldwell's Agricultural Analysis is the text book. Second term: Organic chemistry, twice a week; quantitative analysis continued, embracing volumetric methods and food analysis. Organic chemistry is taught both practically and theoretically.

Senior year.—First term: Lectures twice a week in agricultural chemistry. Second term: Lectures on food. The value and use of the protein bodies, carbohydrates, fats, and salts are discussed; also the value of different grains and grasses as food, the time for cutting, and the best methods of preservation.

The laboratories cover over four thousand square feet of floor, and can accommodate one hundred students at once, giving each a desk room of eight square feet. Each desk has gas, sink, and faucet, and those fitted for quantitative work are provided with filter pumps. Besides the laboratory, there is a large lecture room, with a store room of equal size.

The original investigations thus far made have been in the line of soil analyses and the analysis of corn and grasses.

Both studies were introduced at the opening of the college in 1869. Since then a laboratory building has been erected by the State at a cost of $30,000.

IOWA COLLEGE, AT GRINNELL.

Physics.—S. J. Buck, professor of mathematics and natural philosophy. One year is devoted to the study of Snell's Olmsted.

Chemistry.—Eliot and Storer's manual, with laboratory practice, is studied for two terms by the classical juniors and the scientific freshmen. In addition, the scientific juniors or seniors are required to spend at least one year upon analytical chemistry. Both qualitative and quantitative analysis are taught.

STATE UNIVERSITY OF IOWA, AT IOWA CITY.

Gustavus Hinrichs, professor of physical science; W. C. Preston, assistant professor.

Physics.—This subject, as ordinarily taught in the high schools, is counted on time on the requirements for admission, but not as a college study nor as equivalent to any of the courses described below. These are as follows, arranged by terms and classes:

Freshman year.—Fall and winter terms: Elementary laboratory work, one afternoon a week—required in the school of science.

Sophomore year.—Spring term: Daily lectures upon general physics—required of all regular students.

Junior year.—Fall term: Part of the course in determinative mineralogy relates to the physical properties of minerals—elective in the school of science. Spring term: Daily lectures upon meteorology, with training in all observations—required in school of science, elective in the philosophical course.

Senior year.—Fall term: Daily experimental lectures upon optics, with lantern projections, introducing instrumental observations—required in school of science and elective in philosophical course. Winter term: Laboratory work in practical physics of a more advanced grade, with instruments of precision—elective in school of science. Spring term: Thesis work for students making a specialty of physics; to this the student may devote two-thirds of his entire time during the term.

In addition to the foregoing, lectures are delivered as follows: To the juniors, ten lectures on electricity and magnetism; to the seniors, in the spring term, lectures on "Chapters in the history of physical science."

Chemistry.—This subject, as taught in the high schools, is counted like physics. The following courses of instruction are given:

Freshman year.—Spring term: Elementary laboratory work, two afternoons a week—required in the school of science.

Junior year.—Fall term: Blowpipe analysis, in connection with determinative mineralogy—elective in school of science. Winter term: Daily lectures upon general chemistry—prescribed in all courses. Spring

term: A practical course in qualitative analysis—elective in school of science.

The rooms assigned to chemistry and physics occupy the first story of one of the university buildings. They comprise a lecture hall, an analytical laboratory, a balance room, an optical room, a meteorological station, a magnetic observatory, and a library. A furnace room and a battery room are in the basement. No charge is made for laboratory work, but each student is held responsible for the apparatus intrusted to him. Text books in both sciences are used for reference only and are supplemented by the notes of the students. A long list of original researches is reported by Professor Hinrichs, representing, however, only his own work and not that of his students or associates.

The history of chemical and physical teaching in this university is not a record of continuous progress. Under the presidency of Dr. Black, in the years 1868 to 1871, a graded course of laboratory work was introduced and thoroughly developed. During Dr. Thatcher's administration, 1871 to 1877, this was practically exterminated, for reasons not at present given. The present administration is now making efforts to reintroduce such work in the newly organized division of the college known as the school of science.

IOWA WESLEYAN UNIVERSITY, AT MT. PLEASANT.

Physics.—Required one term in the preparatory school and two terms in the junior year. Text books, Quackenbos and Deschanel.

Chemistry.—One sophomore term in elementary chemistry and one term in qualitative analysis are required. Quantitative analysis is optional.

Chemistry and physics were taught at this university twenty-five years ago, but laboratories were not opened until 1868.

CORNELL COLLEGE, AT MT. VERNON.

Professor Alonzo Collin.

Physics.—The course occupies thirty-eight weeks. Text book, Atkinson's Ganot. Experiments are performed by the students under direction of the teacher. Each piece of apparatus is operated and explained by some member of the class in presence of the whole class. Original experiments are encouraged. The study is altogether obligatory.

Chemistry.—Thirteen weeks in descriptive and theoretical chemistry, with Barker's text book, are prescribed. Twenty-five weeks are devoted to analytical chemistry, with four hours a week of laboratory practice. This is also prescribed, except that classical students may substitute Greek for it. Students are required to take notes to such an extent that any one acquainted with the subject could tell from them what work had been done. The laboratory is a room 35 by 25 feet, fitted with tables after the style of those at the Columbia College School of Mines.

OSKALOOSA COLLEGE, AT OSKALOOSA.

W. S. Barnard, professor of natural science.

Physics.—Peck's Ganot is studied in the preparatory department. In the junior year there is an advanced course. Students assist in the experiments.

Chemistry.—Studied in the junior year. The text (Youmans) is illustrated by experiments performed by the professor and repeated by the students. The laboratory course in elementary chemistry, &c., is prescribed. Qualitative analysis is taught as an optional study.

TABOR COLLEGE, AT TABOR.

J. E. Todd, professor of natural science.

Physics.—There are three months of recitations from Cooley's text book, early in the course. Later, three months in mechanics and three or four months in general physics. Text book, Snell's Olmsted.

Chemistry.—Studied by the juniors. There is a three or four months' course of recitations, with experiments and occasional lectures. Text book, Eliot and Storer. It is followed by an elective course in qualitative analysis, of from three to six months' duration, with daily laboratory practice.

NEBRASKA.

Doane College, at Crete, reports only elementary work in chemistry and physics, but some experimentation is done by students. For details, see the statistical tables.

Nebraska College and Creighton College failed to report.

UNIVERSITY OF NEBRASKA, AT LINCOLN.

Hiram Collier, professor of general chemistry and physics. Agricultural chemistry is taught by Samuel Aughey, the professor of natural sciences.

Physics.—Instruction is given for one term in the preparatory school, from Cooley's text book. In the junior year, Olmsted is studied for two terms. There is the nucleus of a physical laboratory.

Chemistry.—Taught from Cooley's text book one term in the preparatory school. In the sophomore and junior years, three terms are given to chemistry, one general, the other analytical. The latter is optional with the classical students. Text books, Barker, with Eliot and Storer for analysis. Both qualitative and quantitative work is done.

In the industrial college agricultural chemistry is studied, including agricultural chemical analysis.

Both studies were introduced into the university at its opening in 1871.

MISSOURI.

Besides the institutions described in the text, the following have reported: Central College, Pritchett School Institute, Lincoln College, La Grange College, Baptist College, and St. Louis University.

St. Vincent's College, Lewis College, Woodland College, St. Joseph College, Christian Brothers' College, Drury College, and Central Wesleyan College did not report.

See statistical tables for additional details.

MISSOURI UNIVERSITY, AT COLUMBIA.

Physics.—Professor J. G. Norwood, assisted by T. J. Lowry, the professor of civil engineering. Physics is taught in all the regular collegiate courses during the sophomore year and occupies five hours a week. Instruction is given by lectures and recitations, experimentally illustrated. The collection of apparatus is large and valuable, but no systematic physical laboratory work is reported.

The elements of physics are also taught to the normal class and to such elective students as have time to devote to the subject. This course occupies only half a year, five times a week.

Chemistry.—Professor Paul Schweitzer. Instruction is given in two distinct courses of lectures, of one semester each, accompanied by blackboard exercises and laboratory work. The first is an elementary course upon "phenomenal chemistry," daily, supplemented by a suitable text book to facilitate the study of stoichiometry. Required of all students, except those in the law school. The course may be begun in the freshman year, but it is generally taken by the juniors.

The second course, upon "rational chemistry," daily, is a continuation of the first, on a broader basis; and while the one is merely descriptive of phenomena presented by our senses, the other is inductive, leading to their explanation. Digression is made, toward the end of the course, into organic and applied chemistry. The collection of specimens to illustrate these lectures is large and increasing; and in addition to it there is a set of Knapp's Technological Diagrams. All students working for an academic degree and those who contemplate graduating in agriculture or civil engineering must attend this course. A course of lectures on agricultural chemistry is delivered to students in agriculture, daily, for one semester.

The laboratory is furnished in the most approved style, with working tables, reagents, and apparatus generally. Qualitative analysis is taught by lectures, blackboard exercises, and laboratory work. For blowpipe analysis there is a regularly arranged course. This work is required of all candidates for academic degrees, and also of students in agriculture, medicine, and civil engineering. The course in phenomenal chemistry must precede it.

When the student, upon written and experimental examination, proves himself to be sufficiently familiar with qualitative analysis, quantitative analysis may be taken up. Here also lectures and blackboard exercises go side by side with laboratory practice. A certain amount of work in this line is required of all students taking the courses in science

and in civil engineering, and a somewhat larger amount of students in agriculture.

If, after completing the foregoing course, any student desires to engage in special investigations, either scientific or practical, every facility will be given him.

The charge for ordinary chemicals is three dollars a month. A deposit is made by each student of from $10 to $20, to guarantee the safety of apparatus. The value of articles broken or injured is deducted from this sum, and also a small percentage for the use of apparatus.

Professor Schweitzer submits a long list of original researches, which, however, is too extended for reproduction here. They relate partly to pure and partly to applied chemistry.

MISSOURI UNIVERSITY SCHOOL OF MINES AND METALLURGY, AT ROLLA.

Physics.—Taught by lectures and recitations during the first year of the regular three years' courses. The work of instruction is divided between three of the professors in other departments.

Chemistry.—Charles E. Wait, professor of analytical chemistry and metallurgy. General chemistry is studied by the preparatory class and in the first year of the three years' courses. The preparatory pupils begin the subject with the second semester and are taught by text book, recitations, and experiments. The aim is to fit them for the advanced work of the following year and for entrance into the laboratory. In the first year of the regular courses general chemistry is continued, with four exercises a week through both semesters. Chemical philosophy is first introduced and continued through a part of one semester, and many problems are assigned. The remainder of the year is given to theoretical and descriptive chemistry, and the latter part of the course is devoted to organic chemistry, with special reference to the chemistry of animal and vegetable life.

Analytical chemistry is taught during all three years. In the first year, four hours a day are given to actual laboratory practice. The course begins with blowpipe work, then qualitative analysis is taken up, and determinative mineralogy is also entered upon. Lectures are given upon qualitative analysis, in addition to the laboratory exercises.

Quantitative analysis occupies the second and third years. Assaying is also taught.

Special students in chemistry are admitted at any time, and may pursue, at their discretion, the study and analysis of any class of ores or metallurgic products.

WILLIAM JEWELL COLLEGE, AT LIBERTY.

Physics.—Taught in the sophomore year by text book recitations, accompanied with blackboard exercises, lectures, and experiments.

Chemistry.—The junior class have text book recitations throughout the year, with blackboard exercises and experimental lectures. The

students are trained in both the old and the new nomenclature, and are required to be able to translate the one into the other and to work out all chemical problems. The senior class have laboratory practice three times a week and go through a course in manipulation and in qualitative analysis. During the last term they assume the position of instructors, lecturing and experimenting before the junior class. The junior work is prescribed in all courses; that of the senior year is obligatory only upon candidates for the A. M. degree or for graduation in the school of natural science. Original research is not encouraged.

WASHINGTON UNIVERSITY, AT ST. LOUIS.

Physics.—Professor F. E. Nipher. For admission to the Polytechnic School as much physics is required as is contained in the first half of Wells's Natural Philosophy or in Rolfe and Gillett's Handbook. For all engineering and scientific students, physics is an obligatory study during the freshman year and half of the sophomore year. This time is given to recitations and lectures, with class experiments. Text book, Atkinson's Ganot. In all, there are about 180 exercises. During the latter half of the sophomore year laboratory practice is prescribed, and occupies altogether about forty hours.

For scientific students, in addition to the foregoing, lectures and laboratory work are obligatory in the junior year, and laboratory practice of any special kind is elective during the first senior term.

The physical laboratory occupies a room about forty-two feet square on the third floor of the university building. Whenever a series of similar experiments are made, the results of observation are compared with the theory by the graphical method. Students are encouraged to perform original experiments and old experiments by new methods, and in all cases care is taken to secure written reports of all the work done.

Professor Nipher has published several original investigations on the mechanical work done in exhausting a muscle, on the variation of the strength of a muscle, on a new form of lantern galvanometer, on the distribution of errors in numbers written from memory, on the proper length of a gymnasium swing, and on the determination of rainfall in an elevated gauge. He has also done much important work in the line of meteorology.

Chemistry.—Professor Abram Litton. A course on general chemistry, with experiments, is given to the scientific sophomores and the classical juniors during twenty weeks. After that, laboratory practice for one or two years is obligatory upon the scientific students, but optional in the collegiate department.

In the Polytechnic School the special course in chemistry begins with the junior year. There are in this year lectures upon theoretical and organic chemistry and from four to six hours daily in laboratory practice. The latter is in qualitative and quantitative analysis and deter-

minative mineralogy. Geology and English composition are the remaining studies of the year. The seniors study political economy, write themes, prepare a thesis, and spend much time daily in the laboratory working upon analytical and applied chemistry, including some pharmaceutical work, toxicology, and assaying.

The chemical building contains three work rooms, besides a lecture room, the professor's room, and two rooms for storage and apparatus; also, two large rooms in the basement of another building have been fitted up for assaying and industrial chemistry.

Chemistry was first taught here in about 1857 or 1858, and the chemical laboratory was completed and opened in 1859. Physics was first taught here in 1858 by General Reynolds, and afterwards by General Schofield until 1861. Then Dr. Litton took charge of it for a year or two. Later, Professor D. Arnold taught physics until 1874, when F. E. Nipher was appointed assistant professor. The latter became full professor in 1875. The chair of physics was endowed by Wayman Crow, esq., with the sum of $25,000.

KANSAS.

Baker University reported, but as only elementary scientific work is done there the necessary information is easily given in the statistical tables.

St. Benedict's College, Highland University, Lane University, Ottawa University, St. Mary's College, and Washburn College failed to report.

UNIVERSITY OF KANSAS, AT LAWRENCE.

Physics.—Herbert S. S. Smith, professor in charge of physics, astronomy, civil engineering, and free hand drawing. The middle preparatory class has a course of twenty weeks in Avery's Natural Philosophy. In the junior collegiate year instruction is given based upon Olmsted's text book, supplemented by lectures and experiments. The classical students have five exercises a week for twenty weeks; the scientific and modern literature students, five a week for forty weeks. There is a good collection of apparatus, but no facilities are offered for laboratory work or post graduate instruction.

The second year "English normal" class is given a course like that taken by the preparatory students, but arranged with special reference to their duties as teachers.

Chemistry.—George E. Patrick, professor of chemistry, mineralogy, and metallurgy. All sophomores take this study for twenty weeks, with five exercises a week. An "exercise" may be either a recitation or a lecture one hour long, or laboratory practice for two hours. The text book is Barker's. The laboratory work of general students consists of experiments illustrating equivalence and the properties of elements, and a very elementary course in qualitative analysis.

The special course in chemistry diverges from the general scientific

course at the beginning of the junior year. From this point on, it is as follows:

Junior class.—First session: Inorganic chemistry, twenty weeks; quantitative analysis, gravimetric, twenty weeks; logic and physiology, ten weeks each. Second session: Organic chemistry, ten weeks; quantitative analysis, gravimetric, ten weeks; physics and astronomy, twenty weeks each.

Senior class.—First session: Organic chemistry; quantitative analysis, organic and volumetric, twenty weeks. Meteorology, mineralogy, and geology, ten weeks each. Second session: Blowpipe analysis, assaying, and original chemical work, fifteen weeks; political economy, fifteen weeks.

During these two years at least twenty hours of laboratory practice are required.

The space assigned to chemistry is as follows: A lecture room, 24 by 42 feet; a general laboratory, 22 by 45 feet, fitted with tables, cases, gas, water, &c., suitable for the accommodation of thirty students; stock and apparatus room, 12 by 38; specialists' room, 24 by 42 feet, partially fitted up; assay and furnace room.

Both studies were introduced at the opening of the State university, in 1866. In 1873 chemistry was given a more prominent place. The special course was organized in 1876. In 1878, the chair of chemistry and physics was divided and both subjects were put upon their present footing.

KANSAS STATE AGRICULTURAL COLLEGE, AT MANHATTAN.

G. H. Failyer, professor of chemistry and physics.

Physics.—Taught for five months during the second year of the regular courses. Text book, Peck's Ganot. The work includes experimental study in the physical laboratory.

Chemistry.—During the third year, four months are devoted to inorganic chemistry, with laboratory practice. One month is also given to organic chemistry, with laboratory work continued. Qualitative analysis is taught for four months in addition to the foregoing. In the woman's course the latter subject is replaced by a course of lectures upon household chemistry. This embraces the chemistry of cooking, the composition of foods, the ripening and preservation of fruits, &c.

Students in the fourth year of the farmer's course devote three months to agricultural chemistry, some time to blowpipe analysis and determinative mineralogy, and, if they desire, take also a course in quantitative analysis. Special courses are also offered in assaying, pharmaceutical chemistry, and photography.

COLORADO.

The University of Colorado neglected to report.

MINING INSTITUTE CONNECTED WITH COLORADO COLLEGE, AT COLORADO SPRINGS.

J. H. Kerr, professor of chemistry and geology and instructor in mining and metallurgy.

Physics.—Taught for two terms in the second year preparatory class. Text book, Balfour Stewart.

Chemistry.—Begun with Eliot and Storer's text book. In the laboratory the student learns not only to perform the experiments, but also to construct his own apparatus. He is also encouraged to get other experiments from other authors. This course is followed by qualitative and quantitative analysis.

Classes in these subjects, the first organized in Colorado south of Denver, were opened at this college in 1875.

STATE SCHOOL OF MINES, AT GOLDEN.

Milton Moss, professor of analytical and applied chemistry; Gregory Board, professor of mineralogy, metallurgy, and assaying.

Chemistry is taught with particular reference to its applications in metallurgy, geology, and mineralogy. There is a two years' course, during which the students are expected to occupy themselves in the laboratory a large part of the time, enough to obtain a good practical knowledge of analytical chemistry and the assaying of ores. Physics is taught incidentally to the departments already mentioned.

CALIFORNIA.

In addition to the institutions described below, St. Mary's College, Pacific Methodist College, and Hesperian College reported. See statistical tables.

The Missionary College of St. Augustine, Pierce Christian College, St. Vincent's College, Santa Clara College, University of the Pacific, College of Our Lady of Guadalupe, California College, and Washington College failed to report. Some catalogues have been consulted in the process of tabulation.

UNIVERSITY OF CALIFORNIA, AT BERKELEY.

Physics.—John Le Conte, president and professor of physics; Edward A. Parker, instructor in physics and mechanics. Taught in the classical and literary courses throughout the latter half of the junior and the whole of the senior year. In the scientific departments it is studied during the sophomore and senior years, except that in the college of agriculture the senior work in physics is elective and some time is given to the subject in the second junior term. Mechanics is studied in all of the scientific courses except that of agriculture during the junior year. In the last named course it is put down only for the first junior term. In the college of mechanics this branch of physics is continued through the senior year. Text book, Snell's Olmsted, with other works for reference. The sophomore class study heat and the seniors take up capillarity, electricity and magnetism, acoustics, and optics. Instruction is given by lectures and recitations, accompanied by experimental demon-

strations and the solution of practical problems. There is a very complete cabinet of physical apparatus, but no laboratory work for students is indicated in the university catalogue.

Chemistry.—W. B. Rising, professor of chemistry; E. W. Hilgard, professor of agriculture, agricultural chemistry, and botany; F. S. Sutton, assistant in agricultural chemistry; Edward Booth, S. B. Christy, and J. M. Stillman, instructors in chemistry; August Harding, assistant in chemistry. To students in the classical course lectures upon chemistry are delivered during the first half of the junior year. Students in the literary course take chemistry both in the lecture room and the laboratory throughout the sophomore year and may continue it as an elective in the first junior term.

In the several scientific departments a course of general and theoretical chemistry is given during the latter half of the freshman and the whole of the sophomore year. It embraces the elements of both inorganic and organic chemistry, and includes lectures, recitations, and laboratory work. The last is of an elementary character. In the college of mining, in addition to the foregoing, a course of lectures upon general and theoretical chemistry, more advanced than that previously mentioned, is given to the juniors; and analytical chemistry, both qualitative and quantitative, is studied through the junior and senior years. In the college of agriculture the advanced lectures to the juniors are also given, together with a course upon organic chemistry in the senior year. Chemical analysis, with its special bearings upon agriculture, is carried through both the junior and the senior classes, and the juniors have also special instruction in agricultural chemistry. In the college of chemistry the entire four years' course of study leading to a degree is as follows:

First year.—First term: Algebra, French or German begun, rhetoric, English composition, free hand drawing, Spanish (optional throughout the year). Second term: Geometry, chemistry (recitations and laboratory practice), French or German, English composition, English (history of the language), free hand drawing.

Second year.—First term: Trigonometry, analytical geometry, chemistry, physics, botany, French or German, English composition, industrial drawing, Spanish (optional throughout the year). Second term: Analytical geometry, land surveying and levelling, qualitative analysis, physics, botany (elective), French or German, history (elective), industrial drawing.

Third year.—First term: Inorganic chemistry (lectures), analytical chemistry, mineralogy, mechanics, zoölogy, German or French. Second term: Inorganic chemistry (lectures), analytical chemistry, mineralogy, mechanics, zoölogy (elective), French or German, history (optional), Spanish (optional).

Fourth year.—First term: Organic chemistry (lectures), analytical chemistry, mineralogy (laboratory work); physics, geology, astronomy

(elective), metallurgy (elective), political economy. Second term: Organic chemistry (lectures), analytical chemistry, mineralogy (laboratory work), physics, geology, law (lectures, optional), thesis for graduation.

Students taking this course spend at least fifteen hours a week in the laboratory during the junior year and twenty hours a week during the senior year. Practical instruction in electrometallurgy is given to such students as desire it. Special students in chemistry are received.

The laboratories are open daily, including Saturdays. The room for quantitative analysis has accommodations for thirty-two students. Adjoining it are the laboratory and study of the professor, the balance room, and the fusion room. Below is a room for qualitative analysis, also with accommodations for thirty-two students. Adjacent to this is a room devoted to work in elementary chemistry. A charge of fifteen dollars a term is made for chemicals used in analysis. Breakage is also charged upon apparatus.

ST. IGNATIUS COLLEGE, AT SAN FRANCISCO.

Physics.—Rev. J. M. Neri, S. J. Text book, Atkinson's Ganot. The first year in physics is devoted to the general properties of bodies, matter, and force, hydrostatics, pneumatics, acoustics, and heat. In the second year optics, magnetism, electricity, and meteorology are discussed. The first year is obligatory upon all candidates for the A. B. degree, and the second year in addition for the degree of A. M.

The collection of physical apparatus is valued at over fifty thousand dollars. Popular experimental lectures are given by Father Neri, aided by students. No laboratory work in physics and no original researches have been reported.

Chemistry.—In the first year general inorganic chemistry and the elements of organic chemistry are studied. The second year is devoted to analytical chemistry. The requirements are the same as with physics. No research work has yet been published from the institution.

OREGON.

Reports were received from the institution described below and from Pacific University, McMinnville College, and Christian College. For details, see the statistical tables.

Corvallis College, the University of Oregon, Philomath College, and Willamette University neglected to report.

STATE AGRICULTURAL COLLEGE, AT CORVALLIS.

Physics.—The course is not fully described. Maxwell on Heat, Jenkin on Electricity, and Airy on Light are reported as the text books used.

Chemistry.—The course includes chemical physics, general chemistry, chemical philosophy, and qualitative analysis. Roscoe, Cooke's Chem-

ical Philosophy, Thorpe's Chemical Problems, and Eliot and Storer's Qualitative Analysis are the text books employed.

These subjects have been taught in this college for about seven years. They are required of all male students, but not of females.

MISCELLANEOUS.

No college reports were received from either Florida or Nevada. From the Territories but one institution reported, namely, the University of Deseret, at Salt Lake City, Utah. Here the course in physics consists of one hundred lectures, illustrated by experiments and problems. In chemistry one hundred lectures, with experiments, are given, followed by a course of twenty weeks in laboratory practice. For additional details, see the statistical tables.

CHAPTER VII.

SCHOOLS OF MEDICINE, DENTISTRY, AND PHARMACY.

Although the medical schools were among the earliest institutions to give chemistry a fair recognition, they have by no means kept up with the recent growth in scientific teaching. This negligence has been due to a variety of interacting causes. The excessive multiplication of medical schools, arising partly from the need of supplying widely separated localities with means of education and partly from professional rivalries, has led to a sort of competition whose chief tendency is to keep down the standard of instruction. For example, in the State of Ohio, Cincinnati has three "regular" or "allopathic" medical schools, Cleveland two, and Columbus two. One such school in each of these centres, with concentrated means and higher standards, would render possible much better work than is done now. Again, the plan of instruction in most American medical schools is hardly favorable to advanced or thorough study in any department. The competition above referred to has brought about a tendency toward graduating the largest number of students in the shortest possible time, with little reference to previous attainments or to the inculcation of exact scientific knowledge. Pupils having barely the rudiments of a common school education are taken, lectured to for five months in the year during two or three years, carried through a series of clinics and a course of dissections, and then are dismissed with a diploma entitling them to "practice medicine." In such a training neither chemistry nor physics can receive proper attention, both subjects being necessarily subordinate to the more strictly professional branches of materia medica, therapeutics, anatomy, physiology, surgery, and so on. Naturally, the great majority of the physicians who have been taught upon this plan, even although they may afterwards perfect themselves in practice and the subjects immediately relative

thereto, do not, unless they have subsequently studied abroad, fairly appreciate the importance to their profession of the two sciences here discussed. This lack of appreciation is one of the great hindrances to growth.

Fortunately, a healthier state of affairs is rapidly developing. The adoption by some of our better medical schools of a three years' graded course, with nine months of actual study in each academic year, is bringing about a most desirable change. In these schools chemistry is taught through two of the three years, both by lectures and by laboratory work, the latter being obligatory. In this forward movement other schools are rapidly joining. Nearly all of them now offer laboratory instruction, at least as an optional study; but they allow time for only very short courses of work.

An extended argument to show the bearings of chemistry and physics upon medicine is hardly necessary, and yet a brief presentation of the main points cannot well be omitted. Every physician has to deal more or less with chemical substances which are used in one way or another as remedies, anæsthetics, disinfectants, and so on. Surely he should be able to recognize these substances with certainty, to distinguish similar bodies accurately one from another, and to detect serious adulterations or impurities. If he lacks this ability, which can be acquired through a moderate course in qualitative analysis, he certainly falls short of being a thoroughly safe practitioner. If an ignorant apothecary misfills his prescriptions, putting dangerous poison in the place of beneficial remedies, the physician should certainly be able, upon examining the mixture, to discover the error. Again, he should know how the substances which he employs are best prepared, and he ought to have sufficient manipulative skill to be able to prepare them. This skill may be worth little to the city physician, who is always within easy reach of supplies; but to the country practitioner it is often invaluable.

An experimental knowledge of urine analysis is also indispensable. The character of the urine is such an important element in the recognition of certain diseases that no physician can afford to be ignorant in this particular; the worst results may follow from such an incapacity. A familiarity with the compatibility or incompatibility of chemical remedies is another essential. Any druggist can show prescriptions in which mutually antagonistic substances are prescribed. The writer, for example, has known sodium carbonate and hydrochloric acid to be ordered on the same prescription by a physician who wished to produce the effects of both remedies. This kind of ignorance, in a greater or less degree, is unfortunately prevalent, and the only safeguard against it is a good theoretical knowledge of elementary chemistry.

Finally, as regards chemistry, an acquaintance with it is essential to professional growth. With its aid a physician can better judge of the probable value of certain classes of new remedies; without it, the leading modern researches in physiology will be unintelligible to him. His

knowledge or ignorance of chemistry may in many cases determine his ability to keep up with the progress of his own profession.

With regard to physics, the arguments for its study by medical men, though potent, are not so striking as those which are urged in behalf of chemistry. The physician is continually using, in one way or another, instruments involving the principles of heat, light, sound, and electricity. Among them I need only mention the thermometer, ophthalmoscope, stethoscope, microscope, and galvanic battery. With each of these he should be not only practically but also theoretically acquainted. Without a knowledge of physics, progress in physiology is altogether impossible. Questions of animal heat, of electric currents in nerves and muscles, of the physical phenomena of the several senses, are constantly arising. Elaborate instruments, such, for example, as the chronograph, the thermopile, the galvanometer, the resistance coil, and the polariscope, are continually employed in delicate physiological investigations. How far can the intelligent physician afford to be ignorant of these matters? In most of our American medical schools to-day the lectures on chemistry are preceded by a short outline of the science of physics; but the work thus done is wholly inadequate. In fact, few of these institutions report anything whatever concerning physics; so that in this direction neither the text of the report nor the tables at its close give any complete information. Here and there we find a few lectures referred to or some text book on medical physics is reported as in use, but beyond these meagre statements there is nothing satisfactory.

In all of the dental schools chemistry is taught by lectures and in a few instances laboratory practice is also provided for. In one or two schools possibly more work is done in this science than is necessary for dentists; but in most cases the error is rather one of deficiency. The dentist, in the routine of his profession, uses many chemical substances, some of them being poisonous, and therefore requiring careful handling. Ether, chloroform, the oxide and chloride of zinc, carbolic acid, and arsenical paste are among the compounds which he employs. He prepares nitrous oxide for use as an anæsthetic, and, if the product is not pure, disaster may result from its administration. It is essential to the well being of his patients that he should deal with all these chemicals intelligently. Therefore chemistry must form a part of his education; and, in order that the teaching may be effective, some laboratory work should constitute a feature of it.

In the colleges of pharmacy, chemistry is of course a prominent branch of study. In some institutions of this class, laboratory work is compulsory, while in others it is optional. The advocates of the latter policy urge, and with some reason, that most of their students are actively engaged in a business which continually requires chemical manipulations, and that therefore it is undesirable to exact during school hours any additional work of that kind. To this it may be replied that the difference between "rule of thumb" dexterity and positive scientific

skill is too great to be ignored. The pharmacist holds, in a measure, life and death in his hands; an error on his part may be fatal, and the clearer his knowledge becomes concerning the substances with which he deals the safer his customers will be. A failure to distinguish between the cyanide and the ferrocyanide of potassium caused not long ago the death of an estimable man; corrosive sublimate has been given in place of calomel; the old time confusion between oxalic acid and epsom salts has become notorious. Such blunders as these cannot be rendered impossible; but their frequency may at least be reduced to a minimum. Whatever increases the intelligence of the apothecary diminishes his liability to such errors.

The arguments which have already been cited in behalf of the study of chemistry by physicians apply with even greater force to students of pharmacy. The druggist should be able to distinguish analytically between substances which outwardly resemble each other, to recognize poisons accurately, and to manufacture many of the ordinary chemical preparations. He ought always to be on his guard against impure and adulterated products; if he is ignorant concerning these matters, he lies at the mercy of dishonest or careless manufacturers. In short, every pharmacist should have a good knowledge of theoretical and descriptive chemistry, a thorough familiarity with qualitative analysis, and, if possible, a little insight into quantitative methods.

The following pages contain an outline of what is reported concerning chemical laboratory work at various medical, dental, and pharmaceutical schools. Some other material is given also; but for fuller details as to courses of study, text books, &c., the statistical tables at the end of the report must be consulted.

MEDICAL SCHOOLS.

I. REGULAR.

Medical School of Maine, Brunswick.—Students may avail themselves of the facilities which Bowdoin College affords for the study of analytical chemistry.

Medical Department of Dartmouth College, Hanover, N. H.—The catalogue makes no statement as to laboratory instruction in chemistry. In order that more time may be given to medical chemistry, students are expected to be familiar, upon entrance, with the elementary principles of physics, such as light, heat, electricity, &c.

Medical School of Harvard University, Boston, Mass.—Professor Edward S. Wood and Instructor W. B. Hills have charge of chemistry. The professor of physiology, H. P. Bowditch, gives instruction in physiological and medical physics. As much knowledge of physics as may be obtained from Balfour Stewart's Elementary Lessons is required for admission to the school.

One year in general chemistry and one year in medical chemistry are

required for graduation. The general chemistry includes both inorganic and organic chemistry and qualitative analysis. The second year's work includes urinary, toxicological, and physiological chemistry. The teaching is mainly by laboratory practice, there being also one lecture and a recitation every week. Graduate students may receive practical instruction in the laboratory in the analysis of urine, the detection of poisons, the examination of blood stains, &c. For this course the laboratory fee is $30.

The laboratory for general chemistry accommodates from ninety to one hundred students. That for medical chemistry can accommodate between eighty and ninety. In the physiological laboratory there is a considerable amount of electrical apparatus.

Chemistry has been taught in this school since 1782. Previous to 1871 the instruction consisted of lectures, with six weeks of laboratory practice in medical chemistry for a limited number of students. In 1871 the present system was adopted, requiring two years of study, with nine months in each year.

Medical Institution of Yale College, New Haven, Conn.—Benjamin Silliman, professor of chemistry. In the winter term, lectures, illustrated by experiments, are given first upon general chemistry, and later upon organic and physiological chemistry and toxicology. In the spring term, theoretical chemistry is taught by recitations, and practical chemistry by laboratory work. The junior class work in elementary qualitative analysis; the middle class students, in advanced analysis, including the examination of drugs, urine, calculi, &c. These exercises consist of three hours' daily work. The senior class is taught to make original researches. A new chemical laboratory has been fitted up.

Chemical instruction began at this school in 1813. Professor Silliman writes that the course is soon to be made more comprehensive and thorough, and this may be done before these pages are in print.

Albany Medical College, Albany, N. Y.—There is a course of forty lectures on inorganic chemistry by Professor W. G. Tucker; also a course of forty lectures on chemical philosophy and organic chemistry by Professor Maurice Perkins. Laboratory work is optional, but it is taken by about two-thirds of those who graduate.

The laboratory is equipped for qualitative analysis and medical chemistry and has desks for fifteen students working at a time. About thrice this number are accommodated, working in classes. The laboratory is open throughout the year, in charge of Professor Tucker.

Medical Department of the University of the City of New York.—Dr. John C. Draper delivers the usual courses of lectures upon chemistry and chemical physics. There is a voluntary laboratory course in certain branches of medical chemistry, which is taken by about one-half of those who graduate. The laboratory measures twenty by forty feet.

Professor Draper reports a long list of researches in medical chemistry and physics published by himself during his connection with this school.

Woman's Medical College of the New York Infirmary, New York City.—The usual lecture course upon chemistry and chemical physics is followed by a short optional course in qualitative analysis, the testing of urine, &c. The laboratory has room for but eight students at a time, and the class is therefore taken in sections.

College of Physicians and Surgeons (Columbia College), New York City. Candidates for graduation must attend two full courses of chemical lectures. The Handbook of Information issued by Columbia College contains no reference to laboratory work in chemistry at this school.

College of Medicine of Syracuse University, Syracuse, N. Y.—Through the first year chemistry is studied practically in the laboratory, with frequent recitations and occasional lectures. During the second year special chemistry, such as urinary analysis, is taken up. Laboratory students are charged five dollars a term for laboratory expenses. The instruction given in medicine at this school is a three years' graded course, with nine months in each academic year. The chemistry, including laboratory work, is obligatory.

Jefferson Medical College, Philadelphia, Pa.—This institution neglected to report. Its catalogue indicates that laboratory instruction in chemistry is provided for, although such work is probably not required of all students.

Woman's Medical College of Pennsylvania, Philadelphia.—No report received. The catalogue states that attendance is required on two courses of lectures in chemistry and that laboratory work is provided for.

Medical Department, University of Pennsylvania, Philadelphia.—This school has adopted the three years' graded plan, chemistry being, with laboratory work, a prescribed study during the first and second years. T. G. Wormley is professor of chemistry and has the assistance of three demonstrators. During the first year, students attend three lectures a week upon general chemistry and have three hours a week of laboratory practice. The latter work includes chemical manipulations and qualitative analysis. Students of the second year have one lecture a week upon medical chemistry. They also spend two hours a week in laboratory practice, learning the general principles of quantitative analysis, both gravimetric and volumetric, the practical examination of urine and other animal fluids, and the recognition and recovery of poisons from the animal body and complex mixtures. A gold medal is awarded for the best written and practical examination in analytical chemistry. The laboratories contain working places for 432 students, 216 in general chemistry and an equal number in medical chemistry.

Chemistry has been taught regularly in this school since 1768, this having been the first institution in the United States to establish a distinct chair of the science in question.

Howard University Medical School, Washington, D. C.—Three lectures a week in chemistry are given during five months. Two such courses are required for graduation. A little optional laboratory practice is provided for.

National Medical College, Columbian University, Washington, D. C.—Two annual courses of lectures in chemistry are required. Laboratory work is optional, but many students take a course of practical analysis.

Medical College of Georgia, Augusta, Ga.—Two courses in chemistry, five months each, must be attended by every candidate for graduation. Four lectures a week are delivered and a certain amount of physics is included in the course. There is a good laboratory, and the first month of the course is mostly occupied by manipulation on the part of the students.

Medical College of Alabama, Mobile, Ala.—There are the usual lectures on chemistry. The questions concerning laboratory work are answered in the negative.

Medical Department of the University of Louisiana, New Orleans.—The usual lectures upon chemistry are delivered. Laboratory work is entirely optional.

Hospital College of Medicine, Louisville, Ky.—Medical chemistry is studied from the date of matriculation to graduation. Two lessons weekly in experimental chemistry are reported as prescribed, but for what length of time is not stated.

Medical Department of the University of Louisville, Louisville, Ky.—The usual lectures are given upon medical chemistry, toxicology, and chemical physics. Laboratory practice is required in the analysis of animal fluids. Opportunity is offered for extra laboratory practice, but students do not avail themselves of it.

Cincinnati College of Medicine and Surgery, Cincinnati, Ohio.—The usual lectures are delivered. Laboratory practice is optional.

Medical College of Ohio, Cincinnati, Ohio.—Two courses of lectures, two a week for five months, are required in chemistry. Instruction is given in medical physics, based on the text books of Fick and Hoh. Laboratory practice in analysis, toxicology, and the examination of urine is provided for, but is optional.

Miami Medical College, Cincinnati, Ohio.—Two courses of lectures in chemistry, five months each, are required for graduation. The laboratory course occupies six weeks, five devoted to general qualitative analysis and the sixth to the examination of urine. The laboratory is very well equipped.

Cleveland Medical College, Cleveland, Ohio.—In chemistry there are three lectures a week for twenty-three weeks. Two such courses are required for graduation. Laboratory work is optional, but occasional classes are formed in qualitative analysis and the volumetric analysis of urine.

Medical Department, University of Wooster, Cleveland, Ohio.—Two

courses of lectures, three a week for the winter session, are prescribed. Laboratory practice, optional, occupies one hour a day during the winter and spring sessions.

Medical College of Evansville, Evansville, Ind.—There are the usual lectures in general and medical chemistry. Laboratory work is not definitely reported.

Medical College of Indiana, Indianapolis.—In addition to attending the usual lectures upon chemistry, students are required to spend three hours a week in laboratory practice. The latter relates especially to medical chemistry.

Chicago Medical College, Chicago, Ill.—Chemical instruction is given during two years of the course. First, three lectures a week on inorganic chemistry for one year, and an equal number on organic chemistry and toxicology through the second year. Laboratory practice, largely in analytical work, is required to the extent of at least one hour a week throughout both years.

Rush Medical College, Chicago, Ill.—During the winter term the course in chemistry consists of lectures, recitations, and laboratory work. In the spring term it is exclusively practical work in the laboratory, with recitations upon the same. One course at least of laboratory practice is obligatory. The laboratory contains twenty-two well fitted desks for analytical work and four desks for advanced practice.

Woman's Hospital Medical College, Chicago, Ill.—Chemistry is taught by recitations from Roscoe's text book, with an occasional lecture to elucidate some point not fully treated in that work. Ten or twelve lectures on chemical physics are given at the beginning of the course. Since February, 1879, students have been required to take a course in qualitative and urine analysis. The laboratory accommodates six pupils at a time.

Department of Medicine and Surgery, University of Michigan, Ann Arbor, Mich.—In the department of "general chemistry" a course of lectures upon chemical physics and general or theoretical chemistry, extending through half an academic year, is attended by both medical and dental students.

The required laboratory work is in two short courses, as follows: (1) Qualitative chemistry—a course of seven weeks' duration, with daily class drill and laboratory practice. The training is mostly with known substances, making study of the characteristics of each base and acid, illustrating incompatibilities and keeping analytical schemes in the background. The students must be able to write the formulæ of the inorganic salts, hydrates, &c., according to quantivalence, before beginning in the laboratory. In this course five successive classes of forty each are taken during the nine months' session. (2) A short course in physiological chemistry, consisting of urine analysis for medical students, and saliva analysis for dental students. This course occupies about six weeks, with class drill three times and laboratory work five

times a week. In the academic year 1878–'79, 211 students took these short courses, working in relays of 30 to 40.

An optional course in physiological chemistry, nine months long, is offered. Last year seven took this course. Encouragement is especially given for original work in continuation of the course, and a few investigations have been published in Foster's Journal. There is also an optional course in toxicology, extending through nine months, but hitherto very few have undertaken it.

Detroit Medical College, Detroit, Mich.—In chemistry two lectures a week are delivered. At least two months of laboratory practice are obligatory. The laboratory contains twenty-four work tables equipped for the study of analysis, the examination of urine, and toxicology.

Medical Department, University of Iowa, Iowa City, Iowa.—Chemistry is taught both by lectures and by laboratory work. Instruction is given in inorganic and organic chemistry, qualitative and urine analysis, and toxicology. In the three years' graded course, attendance upon lectures in chemistry is prescribed for the first year and chemical analysis for the second.

Medical School, University of the State of Missouri, Columbia, Mo.—A knowledge of the elements of physics is required for admission to the senior class. The full course of medical instruction occupies two years, with nine months each year. Students take chemistry during the first year. A course in analytical chemistry is prescribed.

Kansas City College of Physicians and Surgeons, Kansas City, Mo.—Chemistry is taught in the first of the two terms constituting the course. All students are required to do some laboratory work.

St. Louis Medical School, St. Louis, Mo.—Instruction in chemistry is given by lectures and from Roscoe's text book. Laboratory work is optional; but students pursuing practical chemistry have eight hours a week of practice. The laboratory can accommodate sixteen students at a time.

The Medical Department of the University of California, San Francisco.—Lectures upon chemistry are given and attendance is obligatory. No laboratory work is offered.

Medical College of the Pacific, San Francisco, Cal.—Chemistry is taught by lectures. The report states that laboratory practice is in future to be required.

II. ECLECTIC.

Bennett Medical College, Chicago, Ill.—Chemistry is taught by lectures. There is a laboratory, but work in it is optional.

Eclectic Medical Institute, Cincinnati, Ohio.—The senior class are required to perform the more common chemical manipulations.

III. HOMŒOPATHIC.

Boston University School of Medicine, Boston, Mass.—In addition to attendance upon chemical lectures, some laboratory work in medical chemistry is required.

New York Homœopathic Medical College, New York City.—Laboratory work in chemistry is optional, but instruction is offered in qualitative analysis, toxicology, and the examination of urine.

Hahnemann Medical College, Philadelphia, Pa.—Laboratory work is optional. About thirty or forty students annually take it. The laboratory has tables for twelve students at a time.

Homœopathic Hospital College, Cleveland, Ohio.—The report gives the course of chemistry as treating of the "histology and microchemistry of the tissues." Laboratory work is not definitely described, but a printed examination paper on volumetric urinary analysis is appended.

Hahnemann Medical College of Chicago, Chicago, Ill.—The laboratory accommodates ten or twelve students at a time. Work in it is optional.

Homœopathic College, University of Michigan, Ann Arbor.—The course in chemistry is the same as that described under the regular department of medicine of this university.

Missouri School of Midwifery, St. Louis, Mo.—Only the elements of chemistry are taught, without laboratory work.

DENTAL SCHOOLS.

Harvard Dental College, Boston, Mass.—The teaching in chemistry is identical with that of the Harvard Medical School, is by the same teachers, and in the same classes.

Boston Dental College, Boston, Mass.—Chemical instruction is given entirely by lectures.

New York College of Dentistry, New York City.—Chemistry is taught by lectures. No laboratory work is required.

Pennsylvania College of Dental Surgery, Philadelphia, Pa.—In chemistry there is the ordinary medical school course, with metallurgy and practical laboratory teaching. The latter is given twice a week.

Baltimore College of Dental Surgery, Baltimore, Md.—Laboratory practice occupies one-third of the time given to chemistry.

Ohio College of Dental Surgery, Cincinnati, Ohio.—The chemical course occupies four months, with no laboratory practice.

Dental College of the University of Michigan, Ann Arbor.—The chemical course has already been described in connection with the medical department of the university.

Western College of Dental Surgeons, St. Louis, Mo.—There is but little laboratory work in chemistry offered. The chemical lectures relate partly to the chemistry of the mouth and stomach, of anæsthetics, and of the metals and materials used in dentistry.

SCHOOLS OF PHARMACY.

Massachusetts College of Pharmacy, Boston, Mass.—In chemistry one hour a week of laboratory practice is required. The laboratory accommodates sixty-four students at a time.

The College of Pharmacy of the City of New York.—The prescribed study of chemistry covers two winter courses. General and pharmaceutical chemistry are obligatory branches, and analytical chemistry is included in the examination; but laboratory work at the college is optional.

The lectures on general chemistry are delivered by Professor C. F. Chandler. Professor Charles Froebel has charge of the laboratory and gives instruction in qualitative analysis, quantitative analysis (both gravimetric and volumetric), organic analysis (proximate and ultimate), and medical chemistry, including the examination of pathological specimens, blood, urine, &c. Owing to the rule of the college, however, that students shall not be permitted to waste their time on advanced subjects without having first sufficiently mastered the prerequisite more elementary branches, the attendance upon higher analytical work is comparatively limited. Students in the laboratory are permitted to do any work which the professor considers fit for their abilities and knowledge. The best students, who have gone through qualitative analysis and have sufficiently advanced in quantitative work, may take up any special line of study. No student, however, is allowed to change or abandon, without adequate cause, a subject which he has once undertaken until he has finished it.

The laboratory has separate working places for its sixty students, a special balance room, and a furnace room containing furnace, vapor chambers, and apparatus for organic analysis.

Philadelphia College of Pharmacy, Philadelphia, Pa.—The laboratory can accommodate sixty pupils, but work in it is optional.

Maryland College of Pharmacy, Baltimore, Md.—One course in laboratory work is required.

National College of Pharmacy, Washington, D. C.—Laboratory practice in analytical chemistry is obligatory.

Louisville College of Pharmacy, Louisville, Ky.—Laboratory practice is as yet optional.

Cincinnati College of Pharmacy, Cincinnati, Ohio.—Laboratory work is obligatory during one term of five months. The laboratory can accommodate thirty students at a time. Students are also entitled, free of all tuition charges, to attend the courses in chemistry at the University of Cincinnati.

Chicago College of Pharmacy, Chicago, Ill.—Students are expected, but not yet required, to pursue a complete course in qualitative analysis. The laboratory can accommodate fifteen students at a time.

School of Pharmacy, University of Michigan, Ann Arbor.—In addition to attending regular lectures upon general chemistry the students are required to work in the chemical laboratory through two collegiate years of nine months each, about three hours a day and five days in a week.

The classroom work, recitations, &c., for laboratory branches is done outside of laboratory hours. The classes are as follows: (1) Qualitative analysis, classroom drill daily, five and a half to six months; (2) quan-

titative analysis, volumetric and gravimetric, with specific gravity work, classroom drill three times a week, three months; (3) pharmaceutical preparations, three months; (4) proximate organic analysis, six to eight weeks; (5 and 6) urine analysis and toxicology, in each, classroom drill three times a week, both three months. Original work, under assignment and supervision, is required to be done, either in the chemical or the microbotanical laboratory. About two months' time is obtained for it, sometimes three months. Chemical subjects are chosen by about four-fifths of the scholars. For three or four years past, in about two-thirds of the cases, the results have been reported for publication. Two or three students are frequently put upon one investigation, and related investigations are undertaken by a considerable portion of the class. If only considered as a means of training, this work is worth much more than any other done in the same length of time. A list of the investigations thus carried out and published was issued in 1876 in an eight page octavo pamphlet. Between ninety and a hundred laboratory students are annually in attendance. For an account of the laboratory, see the description given in connection with the university in one of the foregoing chapters.

St. Louis College of Pharmacy, St. Louis, Mo.—The senior class are required to take a course in qualitative analysis.

California College of Pharmacy, San Francisco, Cal.—A laboratory course has not yet been established.

APPENDIX.

LIST OF TEXT BOOKS RELATING TO CHEMISTRY AND PHYSICS.

I. GENERAL PHYSICS.

1. ARNOTT, N. Elements of physics. 7th ed. Edited by Alexander Bain and Alfred Swaine Taylor. *London, Longmans.*
2. AVERY, E. M. Elements of natural philosophy. *N. Y., Sheldon & Co.*
3. BARTLETT, W. H. C. Elements of acoustics and optics. *N. Y., Barnes.*
4. BIRD, GOLDING. Elements of natural philosophy. *London, Churchill.*
5. BROOKE, C. The elements of natural philosophy. Based on the work of the late Dr. Golding Bird. *London, Churchill.*
6. COMSTOCK, J. L. System of natural philosophy. *N. Y., Sheldon.*
7. COOLEY, LE ROY C. Natural philosophy. *N. Y., Scribner.*
8. DAVIS, W. S. Acoustics, light, and heat. *N. Y., Putnam.*
9. DESCHANEL, A. P. Elementary treatise on natural philosophy; translated by J. D. Everett. *N. Y., Appleton.*
10. DRAPER, J. W. Text book on natural philosophy. *N. Y., Harpers.*
11. EVERETT, J. D. Elementary text book of physics. *London, Blackie.*
12. FOSTER. Physics. *Schenectady, Barhydt.*
13. GANOT, A. Elementary treatise on physics, experimental and applied; translated and edited by E. Atkinson. *N. Y., Wood.*
14. GANOT, A. Natural philosophy for general readers and young persons; translated by E. Atkinson. *N. Y., Appleton.*
15. GRAY, ALONZO. Elements of natural philosophy. *N. Y., Harpers.*
16. GUTHRIE, F. Practical physics. Molecular physics and sound. *N. Y., Holt.*
17. HILL, G. A. Questions and exercises on Stewart's lessons in elementary physics. *Boston, Ginn & Heath.*
18. HOTZE, C. L. First lessons in physics. *St. Louis, Central Publishing Co.*
19. HOTZE, C. L. Questions and problems in elementary physics. *St. Louis, Central Publishing Co.*
20. HOUSTON, E. J. Easy lessons in natural philosophy. *Philadelphia, Eldredge.*
21. HOUSTON, E. J. Elements of natural philosophy. *Philadelphia, Eldredge.*
22. JAMIN, J. Petit traité de physique. *Paris.*
23. JOHNSON, F. G. Natural philosophy, and key to philosophical charts. *N. Y., Schermerhorn.*
24. JOHNSTON, J. Primary natural philosophy. *Philadelphia, Desilver.*
25. JOHNSTON, J. Manual of natural philosophy. *Philadelphia, Desilver.*
26. KIRCHHOFF, G. Vorlesungen über mathematische Physik. *Leipzig, Teubner.*
27. LEES, W. Acoustics, light, and heat. *N. Y., Putnam.*
28. LOOMIS, E. Elements of natural philosophy. *N. Y., Harpers.*
29. MARTINDALE, J. C. First lessons in natural philosophy. *Philadelphia, Eldredge.*
30. MAYER, A. M. Lecture notes on physics.
31. MENDENHALL, G. Primary physics.
32. NORTON, S. A. Elements of natural philosophy. *Cincinnati, Van Antwerp, Bragg & Co.*

33. NORTON, S. A. Elements of physics. *Cincinnati, Van Antwerp, Bragg & Co.*
34. OLMSTED, D. Compendium of natural philosophy; revised by E. S. Snell. (Smaller work.) *N. Y., Clark & Maynard.*
35. OLMSTED, D. Introduction to natural philosophy; revised by E. S. Snell. (Larger work.) *N. Y., Collins.*
36. OLMSTED, D. Rudiments of natural philosophy and astronomy. *N. Y., Collins.*
37. PARKER, R. G. School compendium of natural and experimental philosophy. New edition, enlarged by G. W. Plympton. *N. Y., Collins.*
38. PECK, W. G. Introductory course of natural philosophy. Edited from Ganot's Popular Physics. *N. Y., Barnes.*
39. QUACKENBOS, G. P. Natural philosophy. *N. Y., Appleton.*
40. RODWELL, G. F. Notes on natural philosophy. *London, Churchill.*
41. ROLFE, W. J., and GILLET, J. A. Natural philosophy for high schools and academies. *N. Y., Potter, Ainsworth & Co.*
42. ROLFE, W. J., and GILLET, J. A. Natural philosophy for school and home use. *N. Y., Potter, Ainsworth & Co.*
43. SANGSTER. Physics.
44. SILLIMAN, B., jr. First principles of physics, or natural philosophy. *N. Y., Ivison, Blakeman & Taylor.*
45. STEELE, J. D. Fourteen weeks in natural philosophy. *N. Y., Barnes.*
46. STEELE, J. D. Fourteen weeks in physics. *N. Y., Barnes.*
47. STEWART, BALFOUR. Lessons in elementary physics. *London, Macmillan.*
48. STEWART, B. Primer of physics. *N. Y., Appleton.*
49. SWIFT, MARY A. First lessons in natural philosophy. Two parts. *Hartford, Hamersley.*
50. THOMSON, Sir W., and TAIT, P. G. The elements of natural philosophy. Part I. *London, Macmillan.*
51. TODHUNTER, I. Natural philosophy for beginners. Part I. The properties of solid and fluid bodies. Part II. Sound and light. 2 vols. *London, Macmillan.*
52. TYNDALL, J. Light and electricity. Notes of two courses of lectures. *N. Y., Appleton.*
53. WELLS, D. A. Natural philosophy. *N. Y., Ivison, Blakeman & Taylor.*

II. MECHANICS, INCLUDING HYDROSTATICS AND PNEUMATICS.

54. BALL, R. S. Experimental mechanics. *London, Macmillan.*
55. BARTLETT, W. H. C. Elements of analytical mechanics. *N. Y., Barnes.*
56. BARTLETT, W. H. C. Elements of synthetic mechanics. *N. Y., Barnes.*
57. CHERRIMAN. Mechanics.
58. GOODEVE, T. M. Principles of mechanics. *London, Longmans.*
59. JACKSON. Mechanics.
60. MAGNUS, P. Lessons in elementary mechanics. Emendations and preface by Professor DeVolson Wood. *N. Y., Wiley.*
61. MAGNUS, P. Hydrostatics and pneumatics. *London, Longmans.*
62. PARKINSON, S. An elementary treatise on mechanics. *London, Macmillan.*
63. PECK, W. G. Elementary treatise on mechanics. *N. Y., Barnes.*
64. PECK, W. G. Elements of mechanics; with calculus. *N. Y., Barnes.*
65. PHEAR, J. B. Elementary hydrostatics. *London, Macmillan.*
66. RANKINE, W. J. M. Manual of applied mechanics. *London, Griffin.*
67. SMITH, A. W. Elementary treatise on mechanics. *N. Y., Harpers.*
68. STURM, C. Cours de mécanique de l'École polytechnique. *Paris, Gauthier-Villars.*
69. TODHUNTER, I. Mechanics for beginners. *London, Macmillan.*
70. TWISDEN, J. F. First lessons in theoretical mechanics. *London, Longmans.*
71. WOOD, DE VOLSON. The elements of analytical mechanics. *N. Y., Wiley.*
72. WOOD, DE VOLSON. The principles of elementary mechanics. *N. Y., Wiley.*
73. WORMELL, R. Hydrostatics. *London, Longmans.*

III. SOUND.

74. AIRY, G. B. On sound and atmospheric vibrations. *London, Macmillan.*
75. DONKIN, W. F. Acoustics. Theoretical. *London, Macmillan.*
76. HELMHOLTZ, H. Die Lehre von den Tonempfindungen. *Braunschweig, Vieweg und Sohn.*
77. MAYER, A. M. Sound: a series of simple, entertaining, and inexpensive experiments in the phenomena of sound. *N. Y., Appleton.*
78. STONE, W. H. Elementary lessons on sound. *London, Macmillan.*
79. TYNDALL, J. On sound. A course of eight lectures. *N. Y., Appleton.*

IV. LIGHT.

80. AIRY, G. B. On the undulatory theory of optics. *London, Macmillan.*
81. AIRY, OSMUND. A treatise on geometrical optics. *London, Macmillan.*
82. LOMMEL, E. The nature of light. International scientific series. *N. Y., D. Appleton & Co.*
83. MAYER, A. M., and BARNARD, C. Light: a series of experiments in the phenomena of light. *N. Y., Appleton.*
84. PARKINSON, S. A treatise on optics. *London, Macmillan.*
85. TYNDALL, J. Six lectures on light delivered in America. *N. Y., Appleton.*
86. VERDET, E. Leçons d'optique physique. *Paris, Levistal.*

V. HEAT.

87. BAYNES, R. E. Lessons on thermodynamics. *London, Macmillan.*
88. CLAUSIUS, R. The mechanical theory of heat. Edited by T. A. Hurst. *London, Van Voorst.*
89. EDDY, H. T. Thermodynamics. *N. Y., Van Nostrand.*
90. GORDON, J. E. H. An elementary book on heat. *London, Macmillan.*
91. MCCULLOCH, R. S. Treatise on the mechanical theory of heat, and its applications to the steam engine. *N. Y., Van Nostrand.*
92. MAXWELL, J. C. Theory of heat. *N. Y., Appleton.*
93. RANKINE, W. J. M. Manual of the steam engine. *London, Griffin.*
94. SHANN, G. An elementary treatise on heat in relation to steam and the steam engine. *London, Macmillan.*
95. STEWART, BALFOUR. An elementary treatise on heat. *London, Macmillan.*
96. TYNDALL, J. Heat as a mode of motion. *N. Y., Appleton.*
97. WATSON, H. W. A treatise on the kinetic theory of gases. *London, Macmillan.*
98. WORMELL, R. Thermodynamics. Edited by G. C. Foster and P. Magnus. *London, Longmans.*
99. ZEUNER, G. Théorie mécanique de la chaleur. *Paris, Gauthier-Villars.*

VI. ELECTRICITY AND MAGNETISM.

100. AIRY, G. B. A treatise on magnetism. *London, Macmillan.*
101. ANGELL, J. Magnetism and electricity. *N. Y., Putnam.*
102. CLARK, LATIMER. Elementary treatise on electrical measurements. *London, Spon.*
103. CUMMING, L. An introduction to the theory of electricity. *London, Macmillan.*
104. GUTHRIE, F. Magnetism and electricity. *N. Y., Putnam.*
105. JENKIN, FLEEMING. Electricity and magnetism. *N. Y., Appleton.*
106. MAXWELL, J. C. A treatise on electricity and magnetism. 2 vols. 8vo. *London, Macmillan.*
107. NOAD, H. M. The student's text book of electricity. New edition, revised, with introduction and additional chapters, by W. H. Preece. *London, Lockwood.*
108. SPRAGUE, J. T. Electricity: its theory, sources, and applications. *N. Y., Spon.*
109. TYNDALL, J. Lessons in electricity. *N. Y., Appleton.*

VII. CHEMICAL PHYSICS.

110. COOKE, J. P., jr. Elements of chemical physics. *Boston, Allyn.*
111. MILLER, W. A. Chemical physics. *N. Y., Wiley.*
112. PYNCHON, T. R. Introduction to chemical physics. *N. Y., Van Nostrand.*

VIII. MEDICAL PHYSICS.

113. FICK, A. Die medicinische Physik. *Braunschweig, Vieweg und Sohn.*
114. HOH, T. Die Physik in der Medicin. *Stuttgart, Enke.*

IX. PHYSICAL MANIPULATIONS.

115. FRICK, J. Physical technics; translated by J. D. Easter. *Phila., Lippincott.*
116. KOHLRAUSCH, H. F. Introduction to physical measurements; translated by T. H. Waller and H. Richardson. *N. Y., Appleton.*
117. PICKERING, E. C. Elements of physical manipulation. 2 vols. *N. Y., Hurd & Houghton.*

X. GENERAL CHEMISTRY.

118. APJOHN, J. Manual of the metalloids.
119. APPLETON, J. H. A class book of modern chemistry. *Providence, Hammond, Angell & Co.*
120. APPLETON, J. H. The young chemist. A new book of chemical experiments for the use of beginners in chemistry. *Philadelphia, Cowperthwait.*
121. ARNOLD, B. Elementary chemistry. *London, Boulton.*
122. BAKER. Chemistry. (Possibly error for Barker.)
123. BARFF, F. S. An introduction to scientific chemistry. *London, Groombridge.*
124. BARKER, G. F. College chemistry. *Louisville, Morton.*
125. BECK, L. C. Manual of chemistry. *Philadelphia, Lippincott.*
126. BERNAYS, A. J. Notes for students in chemistry. *London, Churchill.*
127. BLOXAM, C. L. Chemistry, inorganic and organic. *Philadelphia, Lea.*
128. BLOXAM, C. L. Laboratory teaching; or, progressive exercises in practical chemistry. *Philadelphia, Lindsay & Blakiston.*
129. BLOXAM, C. L. Metals: their properties and treatment. *London, Longmans.*
130. BRANDE, W. T., and TAYLOR, A. S. Chemistry. *Philadelphia, Lea.*
131. BREIDENBAUGH, E. S. Lecture notes on elementary (inorganic) chemistry. *Gettysburg.*
132. BUCKMASTER, J. C. Inorganic chemistry. *London, Longmans.*
133. CALDWELL, G. C., and BRENEMAN, A. A. Manual of introductory chemical practice. *N. Y., Van Nostrand.*
134. CHURCH, A. H. Laboratory guide. *London, Van Voorst.*
135. COMSTOCK, J. L. Elements of chemistry. *N. Y., Sheldon.*
136. COOKE, J. P., jr. The new chemistry. *N. Y., Appleton.*
137. COOLEY, LE ROY C. Elements of chemistry. *N. Y., Scribner.*
138. DARBY, J. Text book of chemistry, theoretical and practical. *N. Y., Barnes.*
139. DRAPER, H. Text book on chemistry. *N. Y., Harper.*
140. ELIOT, C. W., and STORER, F. H. Manual of inorganic chemistry. *N. Y., Ivison, Blakeman & Taylor.*
141. ELIOT, C. W., and STORER, F. H. Manual of inorganic chemistry; abridged by W. R. Nichols. *N. Y., Ivison, Blakeman & Taylor.*
142. FOSTER, W. First principles of chemistry; illustrated by experiments. *N. Y., Harpers.*
143. FOWNES, G. Manual of elementary chemistry, theoretical and practical; edited by R. Bridges. *Philadelphia, Lea.*
144. FRANKLAND, E. Lecture notes for chemical students. *London, Van Voorst.*
145. GAINES. Chemical alphabet.
146. GALLOWAY, R. The first step in chemistry. *London, Churchill.*

147. GILL, C. HAUGHTON. Chemistry for schools. *London, Walton.*
148. GRAHAM, T. Elements of inorganic chemistry. *Philadelphia, Lea.*
149. GRAY, ALONZO. Elements of chemistry.
150. GREGORY, W. Handbook of inorganic chemistry; edited by J. M. Sanders. *N. Y., Barnes.*
151. HARCOURT, A. G. VERNON, and MADAN, H. G. Exercises in practical chemistry. *London, Macmillan.*
152. HARRIS, E. P. Lecture notes.
153. HART, H. M. Manual of chemistry for advanced students. *N. Y., Cassell.*
154. HICKS, J. W. Inorganic chemistry. *London, Stewart.*
155. HINRICHS, G. Elements of chemistry and mineralogy. *Davenport (Iowa), Day.*
156. HINRICHS, G. Principles of chemistry. *Davenport (Iowa), Day.*
157. HOOKER, W. First book in chemistry. *N. Y., Harpers.*
158. HOWARD, J. Practical chemistry. *N. Y., Putnam.*
159. HUDSON. Inorganic chemistry for science classes.
160. JOHNSTON, J. Elements of chemistry. *Philadelphia, Desilver.*
161. JOHNSTON, J. Manual of chemistry: on basis of E. Turner's elements. *Philadelphia, Desilver.*
162. JONES, F. The Owens College junior course of practical chemistry, with preface by Professor Roscoe. *London, Macmillan.*
163. KAY-SHUTTLEWORTH, U. J. First principles of modern chemistry; a manual of inorganic chemistry. *London, Churchill.*
164. KEMSHEAD, W. B. Inorganic chemistry. *N. Y., Putnam.*
165. LEFFMANN, H. First step in chemical principles; an introduction to modern chemistry. *Philadelphia, Stern.*
166. MACADAM, S. Practical chemistry. With new notation. *London, Chambers.*
167. MILLER, W. A. Elements of chemistry, theoretical and practical. 3 vols. Vol. 1, chemical physics. Vol. 2, inorganic. Vol. 3, organic. *London, Longmans.*
168. MILLER, W. A. Introduction to the study of inorganic chemistry. *London, Longmans.*
169. MORRILL, A. B. Outlines of a short elementary course in general chemistry. *Portland, Me.*
170. MORTON, H., and LEEDS, A. R. Student's practical chemistry. *Phila., Lippincott.*
171. MOTT, H. A., jr. Chemist's manual. *N. Y., Van Nostrand.*
172. MURPHY, J. G. Review of chemistry for students. *Philadelphia, Lindsay & Blakiston.*
173. NAQUET, A. Principes de chimie. 2 vols. *Paris.*
174. NAQUET, A. Principles of chemistry, founded on modern theories; translated by W. Cortis; revised by T. Stevenson. *London, Renshaw.*
175. NORTON, S. A. Elements of chemistry. *Cincinnati, Van Antwerp, Bragg & Co.*
176. OLMSTED, A. F. Chemistry. *N. Y., Lockwood.*
177. PECKHAM, S. F. Elementary chemistry. *Louisville, Morton.*
178. PORTER, J. A. First book of chemistry and allied sciences. *N. Y., Barnes.*
179. REGNAULT, V. Elements of chemistry; edited by J. C. Booth and W. L. Faber. *Philadelphia, Baird.*
180. REYNOLDS, J. E. Short lectures on experimental chemistry. *London, Baillière.*
181. RIGG, A., and GOOLDEN, W. T. An easy introduction to chemistry. *London, Rivingtons.*
182. ROLFE, W. J., and GILLET, J. A. Handbook of chemistry. *N. Y., Potter, Ainsworth & Co.*
183. ROSCOE, H. E. Lessons in elementary chemistry, inorganic and organic. *London, Macmillan.*
184. ROSCOE, H. E. Primer of chemistry. *N. Y., Appleton.*
185. SADTLER, S. P. Chemical experimentation. *Louisville, Morton.*
186. SEMPLE, E. C. A. Aids to chemistry for students. *London, Simpkin.*

187. SHELLEY, C. E. Short notes on chemistry. *London, Macmillan.*
188. SILLIMAN, B., jr. First principles of chemistry. *N. Y., Irison, Blakeman & Taylor.*
189. SMITH, G. Aids to the study of practical chemistry. *London, Stewart.*
190. STEELE, J. D. Fourteen weeks in chemistry. *N. Y., Barnes.*
191. STÖCKHARDT, J. A. The principles of chemistry. *Philadelphia, Butler.*
192. THORPE, T. E. Inorganic chemistry. 2 vols. *N. Y., Putnam.*
193. TIDY, C. M. Handbook of modern chemistry, organic and inorganic. *Philadelphia, Lindsay & Blakiston.*
194. VACHER, A. Primer of chemistry, including analysis. *London, Churchill.*
195. VALENTIN, W. G. Introduction to inorganic chemistry. *London, Churchill,*
196. VALENTIN, W. G. Twenty lessons in inorganic chemistry. *London, Collins.*
197. WELLS, D. A. Principles of chemistry. *N. Y., Irison, Blakeman & Taylor.*
198. WILLIAMSON, A. W. Chemistry for students. *London, Macmillan.*
199. WILSON, G. Chemistry; revised and enlarged by Stevenson Macadam. *Philadelphia, Lippincott.*
200. WILSON, G. Inorganic chemistry: revised and enlarged by H. G. Madan. *London, Chambers.*
201. WOOD, T. Chemical notes for the lecture room. *London, Longmans.*
202. WRIGHT, C. R. A. Metals and their chief industrial applications. *London, Macmillan.*
203. WURTZ, A. Elements of modern chemistry; translated and edited by W. H. Greene. *Philadelphia, Lippincott.*
204. YOUMANS, E. L. Classbook of chemistry. *N. Y., Appleton.*

XI. ORGANIC CHEMISTRY.

205. ARMSTRONG, H. E. Introduction to the study of organic chemistry. *N. Y., Appleton.*
206. CLEMENTS, H. A manual of organic chemistry, practical and theoretical. *London, Blackie.*
207. GREGORY, W. Handbook of organic chemistry. Edited by J. M. Sanders. *N. Y., Barnes.*
208. SCHORLEMMER, C. A manual of the chemistry of the carbon compounds. *London, Macmillan.*
209. WATTS, W. M. Elements of organic chemistry. *N. Y., Putnam.*
210. WHEELER, C. G. Outlines of modern chemistry, organic. *Chicago, Jansen, McClurg & Co.*
211. WÖHLER, F. Outlines of organic chemistry; edited by R. Fittig; translated by Ira Remsen. *Philadelphia, Lea.*

XII. CHEMICAL PHILOSOPHY.

212. COOKE, J. P., jr. First principles of chemical philosophy. *Boston, Allyn.*
213. HOFMANN, A. W. Introduction to modern chemistry. *London, Walton.*
214. REMSEN, I. Principles of theoretical chemistry. *Philadelphia, Lea.*
215. TILDEN, W. A. Introduction to the study of chemical philosophy. *N. Y., Appleton.*

XIII. CHEMICAL PROBLEMS.

216. COOKE, J. P., jr. Chemical problems and reactions. *Philadelphia, Butler.*
217. FOYE, J. C. Chemical problems. *Appleton, Wis., published by the author.*
218. JONES, F. Questions in chemistry: a series of problems and exercises in inorganic and organic chemistry. *London, Macmillan.*
219. THORPE, T. E. Chemical problems, with a preface by Professor Roscoe. *London, Macmillan.*

XIV. ANALYSIS, GENERAL.

220. NOAD, H. M. Manual of chemical analysis, qualitative and quantitative. *London Reeve.*

221. PINK, W. W., and WEBSTER, G. E. A course of analytical chemistry, qualitative and quantitative. *London, Weale's series.*

XV. ANALYSIS, QUALITATIVE.

222. APPLETON, J. H. A book of reactions, for the use of the students in the chemical laboratory of Brown University. *Providence, Reid.*

223. APPLETON, J. H. A short course in qualitative chemical analysis. *Philadelphia, Cowperthwait.*

224. BEILSTEIN, F. An introduction to chemical qualitative analysis; translated by I. J. Osbun. *N. Y., Van Nostrand.*

225. BEILSTEIN, F. Manual of qualitative chemical analysis; translated by W. Ramsay. *N. Y., Putnam.*

226. BOWMAN, J. E. Introduction to practical chemistry, including analysis. *Philadelphia, Lea.*

227. BOWMAN, J. E., and BLOXAM, C. L. Practical chemistry, including analysis. *London, Churchill.*

228. BROWN, J. C. Analytical tables for students of practical chemistry. *London, Churchill.*

229. CLOWES, F. Elementary treatise on practical chemistry and qualitative inorganic analysis. *Philadelphia, Lea.*

230. CRAFTS, J. M. A short course in qualitative analysis, with the new notation. *New York, Wiley.*

231. DITTMAR, W. Analytical chemistry: a series of laboratory exercises, constituting a preliminary course of qualitative chemical analysis. *London, Chambers.*

232. DOLBEAR, A. E. General tables for the qualitative analysis of common inorganic substances.

233. DOUGLAS, S. H., and PRESCOTT, A. B. Qualitative chemical analysis. *New York, Van Nostrand.*

234. EATON. Qualitative analysis.

235. ELIOT, C. W., and STORER, F. H. Compendious manual of qualitative chemical analysis; revised by W. R. Nichols. *New York, Van Nostrand.*

236. ELTOFT, T. A systematic course of practical qualitative analysis. *London, Simpkin.*

237. FOSTER, H. T. Analysis for schools, private teachers, and students.

238. FRESENIUS, C. R. Manual of qualitative chemical analysis; translated into the new system and newly edited by S. W. Johnson. *N. Y., Wiley.*

239. GALLOWAY, R. Manual of qualitative analysis. *Philadelphia, Lea.*

240. HARRIS, E. P. Manual of qualitative analysis.

241. HILL, H. B. Lecture notes on qualitative analysis. *N. Y., Putnam.*

242. HOUGH, J. B. Guide to chemical testing. *Cincinnati, "Lancet."*

243. JARMAIN, G. Systematic course of qualitative analysis. *London, Heywood.*

244. KEDZIE, R. C. Handbook of qualitative chemical analysis.

245. MUTER, J. An introduction to analytical chemistry, for laboratory use. *London, Baillière.*

246. NASON, H. B. Table of reactions for qualitative chemical analysis. *Philadelphia, Baird.*

247. PERKINS, M. Elementary manual of qualitative chemical analysis. *N. Y., Wiley.*

248. PRESCOTT, A. B. First book in qualitative chemistry. *N. Y., Van Nostrand.*

249. SLATER, J. W. Handbook of chemical analysis. *London, Mackenzie.*

250. SNIVELY, J. H. The elements of systematic qualitative chemical analysis. *Nashville, Smith.*

251. SPENCER, W. H. Elements of qualitative chemical analysis. *London, Macmillan.*
252. THORPE, T. E., and MUIR, M. M. P. Qualitative chemical analysis. *London, Longmans.*
253. VALENTIN, W. G. Course of qualitative chemical analysis. *London, Churchill.*
254. VALENTIN, W. G. Tables for the qualitative analysis of simple and compound substances. *London, Churchill.*
255. WILEY, H. W. Tables for qualitative analysis.
256. WILL, H. Tables for qualitative chemical analysis; translated by Prof. C. F. Himes. *Philadelphia, Baird.*

XVI. ANALYSIS, QUANTITATIVE.

257. APPLETON, J. H. An introduction to quantitative analysis. *Providence.*
258. CLASSEN, A. Elementary quantitative analysis: translated, with additions, by E. F. Smith. *Philadelphia, Lea.*
259. CROOKES, W. Select methods of chemical analysis. *London, Longmans.*
260. FRESENIUS, C. R. System of instruction in quantitative chemical analysis; edited, with additions, by S. W. Johnson. *N. Y., Wiley.*
261. RAMMELSBERG, C. F. Guide to a course of quantitative chemical analysis; translated by J. Towler. *N. Y., Van Nostrand.*
262. THORPE, T. E. Quantitative chemical analysis. *N. Y., Wiley.*
263. WÖHLER, F. Handbook of mineral analysis; edited by H. B. Nason. *Philadelphia, Baird.*

XVII. BLOWPIPE ANALYSIS AND ASSAYING.

264. BODEMANN, T., and KERL, B. Treatise on the assaying of lead, silver, copper, gold, and mercury; translated by W. A. Goodyear. *N. Y., Wiley.*
265. BRUSH, G. J. Manual of determinative mineralogy, with introduction on blowpipe analysis. *N. Y., Wiley.*
266. ELDERHORST. Manual of qualitative blowpipe analysis and determinative mineralogy; edited by H. B. Nason and C. F. Chandler. *Phila., Porter & Coates.*
267. MITCHELL, J. Manual of practical assaying; edited by W. Crookes. *N. Y., Wiley.*
268. PLATTNER, C. F. Manual of qualitative and quantitative analysis with the blowpipe; revised and enlarged by T. Richter. Translated by H. B. Cornwall and J. H. Caswell. *N. Y., Van Nostrand.*
269. PLYMPTON, G. W. The blowpipe. A guide to its use in the determination of salts and minerals. *N. Y., Van Nostrand.*
270. RICKETTS, P. DEP. Notes on assaying and assay schemes. *N. Y., Wiley.*

XVIII. VOLUMETRIC ANALYSIS.

271. FLEISCHER, E. A system of volumetric analysis; translated, with notes and additions, by M. M. P. Muir. *London, Macmillan.*
272. HART, E. A handbook of volumetric analysis. *N. Y., Wiley.*
273. SUTTON, F. A systematic handbook of volumetric analysis. *London, Churchill.*

XIX. SPECIAL ANALYSIS.

274. HOFFMANN, F. Manual of chemical analysis as applied to the examination of medical chemicals. *N. Y., Appleton.*
275. PRESCOTT, A. B. Chemical examination of alcoholic liquors. *N. Y., Van Nostrand.*
276. PRESCOTT, A. B. Outlines of proximate organic analysis. *N. Y., Van Nostrand.*

XX. TOXICOLOGY, &C.

277. BECK, T. R. and J. B. Elements of medical jurisprudence.
278. BLYTH, A. W. A manual of practical chemistry: the analysis of foods and the detection of poisons. *N. Y., Wood.*

279. NAQUET, A. Legal chemistry; translated, with additions, by J. P. Battershall, with a preface by C. F. Chandler. *N. Y., Van Nostrand.*
280. OTTO, F. J. On detection of poisons by medico-chemical analysis. *London, Baillière.*
281. REESE, J. J. Manual of toxicology. *Philadelphia, Lippincott.*
282. TAYLOR, A. S. On poisons in relation to medical jurisprudence and medicine. *London, Churchill.*
283. WORMLEY, T. G. The microchemistry of poisons. *N. Y., Wood.*

XXI. URINE ANALYSIS.

284. FLINT, A., jr. Manual of chemical examination of the urine. *N. Y., Appleton.*
285. HARLEY, G. The urine and its derangements: with the application of physiological chemistry to diagnosis, &c. *Philadelphia, Lindsay & Blakiston.*
286. HELLER, J. F. Pathological chemistry of the urine. *London, Longmans.*
287. HOFFMAN, K. B., and ULTZMANN, R. Guide to the examination of urine; translated and edited by F. Forchheimer. *Cincinnati, Thomson.*
288. HOFFMAN, K. B., and ULTZMANN, R. Analysis of the urine; translated by T. B. Brune and H. H. Curtis. *N. Y., Appleton.*
289. LEGG, J. W. Guide to the examination of the urine. *Philadelphia, Lindsay & Blakiston.*
290. MITCHELL, C. Student's manual of urinary analysis. *Chicago, Jansen, McClurg. & Co.*
291. NEUBAUER and VOGEL. Guide to the qualitative and quantitative analysis of the urine, &c., with preface by Professor Fresenius: translated by Dr. E. G. Cutler; revised by Prof. E. S. Wood. *N. Y., Wood.*
292. PIFFARD, H. G. A guide to urinary analysis. *London, Smith & Elder.*
293. THUDICHUM, J. L. W. Pathology of the urine, and analysis. *Philadelphia, Lindsay & Blakiston.*
294. TYSON, J. A guide to the practical examination of the urine. *Philadelphia, Lindsay & Blakiston.*

XXII. MEDICAL AND PHYSIOLOGICAL CHEMISTRY.

295. ATTFIELD, J. Chemistry: General, medical, and pharmaceutical. *Philadelphia, Lea.*
296. BOWMAN, J. E. Practical handbook of medical chemistry; edited by C. L Bloxam. *Philadelphia, Lea.*
297. GAUTIER, E. J. A. Chimie appliquée à la physiologie, à la pathologie. et à l'hygiene. *Paris, Savy.*
298. KLEIN. Physiological chemistry.
299. LEHMANN, C. G. Manual of chemical physiology; translated with notes and additions by J. C. Morris; with essay on vital force by S. Jackson. *Philadelphia, Lea.*
300. LEHMANN, C. G. Physiological chemistry: translated by G. E. Day and edited by R. E. Rogers. 2 vols. *Philadelphia, Lea.*
301. MUIR, M. M. P. Practical chemistry for medical students. *London, Macmillan.*
302. MUTER, J. An introduction to pharmaceutical and medical chemistry, theoretical and descriptive. *London, Baxter.*
303. ODLING, W. Course of practical chemistry, arranged for medical students. *Philadelphia, Lea.*
304. RALFE, C. H. Outlines of physiological chemistry, including the qualitative and quantitative analysis of tissues, fluids, and excretory products. *London, Lewis*
305. RAND, B. H. Elements of medical chemistry. *Philadelphia, Lippincott.*
306. REESE, J. J. Syllabus of medical chemistry. *Philadelphia, Lindsay & Blakiston*

307. VAUGHAN, V. C. Lecture notes on chemical physiology and pathology. *Ann Arbor Printing and Publishing Company.*
308. WHEELER, C. G. Medical chemistry. *Philadelphia, Lindsay & Blakiston.*
309. WITTHAUS, R. A. Essentials of chemistry, inorganic and organic, for the use of students in medicine. *N. Y., Wood.*
310. WITTSTEIN, G. C. Practical pharmaceutical chemistry; edited by Stephen Darby. *London, Churchill.*

XXIII. TECHNOLOGY.

311. WAGNER, R. Handbook of chemical technology; translated and edited, with extensive additions, by William Crookes, F. R. S. *N. Y., Appleton.*

XXIV. AGRICULTURAL CHEMISTRY.

312. CALDWELL, G. C. Agricultural qualitative and quantitative chemical analysis. *New York, Judd.*
313. CHURCH. Agricultural analysis.
314. JOHNSON, S. W. How crops feed. *N. Y., Judd.*
315. JOHNSON, S. W. How crops grow. *N. Y., Judd.*
316. JOHNSTON, J. F. W. Agricultural chemistry. *N. Y., Judd.*
317. LIEBIG, J. von. Chemistry in its applications to agriculture. *N. Y., Wiley.*
318. LIEBIG, J. von. Principles of agricultural chemistry. *N. Y., Wiley.*
319. PENDLETON, E. M. Text book of scientific agriculture; with practical deductions. *N. Y., Barnes.*
320. SIBSON, A. Agricultural chemistry. With preface by A. Voelcker. *London, Routledge.*
321. WOLFF, E. Anleitung zur chemischen Untersuchungen landwirthschaftlich-wichtiger Stoffe. *Berlin, Wiegand, Hempel und Parey.*

XXV. MISCELLANEOUS.

322. BREWER, E. C. Guide to the scientific knowledge of things familiar. *N. Y., Miller.*
323. HOOKER, W. Child's book of nature. *N. Y., Harpers.*
324. HOOKER, W. Science for the school and family. 3 parts. Part 1, natural philosophy. Part 2, chemistry. *N. Y., Harpers.*
325. NORTON, W. A., and PORTER, J. A. First book of science. *N. Y., Barnes.*
326. PETERSON, R. E. Familiar science. *Philadelphia, Sower, Potts & Co.*
327. SCHÖDLER, F. Book of nature: elementary introduction to physics, astronomy, chemistry, geology, &c.; translated by H. Medlock. *N. Y., Sheldon.*
328. WELLS, D. A. The science of common things: a familiar explanation of the first principles of physical science. *N. Y., Ivison, Blakeman & Taylor.*

STATISTICAL TABLES.

EXPLANATORY NOTES.

In the following tables most of the figures speak for themselves, without special explanation or comment. Some of them, however, are abbreviations, to which a key must needs be furnished; and in each column there are certain peculiarities concerning which a word or two may be said with advantage. Table I, which relates to the public schools of cities containing 7,500 inhabitants and over, is somewhat differently arranged from Table II; but it requires no separate commentary. The subjoined notes apply most directly to Table II.

Columns 3, 4, 5, *and* 6.—These explain themselves; showing, as they do, the number of teachers for each science in question, the number for both sciences together, and

whether such teachers are required to instruct in other branches. These data are particularly important; since they indicate in a measure the amount of attention given by a school or college to chemistry and physics, and also whether the instruction is by a specialist or not. In the part of the table relating to universities and colleges, they often show even more than the foregoing. When it is seen that one teacher instructs in both branches and in other subjects also, the probability, verifiable in nine cases out of ten, is that he is "professor of natural sciences." When there is one teacher for chemistry, one for physics, and two for both together, each one having additional duties, the chances are that physics is taught in connection with mathematics and astronomy, while chemistry goes with zoölogy and geology. There are exceptions to these rules, but they are not numerous.

Columns 7, 8, *and* 9.—These show, more or less perfectly, the maturity of the pupils upon beginning chemical and physical studies. Columns 8 and 9, except in relation to universities and colleges, are unavoidably somewhat ambiguous. The difficulty is that there has been no uniform nomenclature for school classes and grades; so that a name may mean one thing in one place and another in another. The ordinary college nomenclature, however, of freshman, junior, &c., is sufficiently definite for all practical purposes.

Columns 10 *and* 11.—These columns indicate, by means of abbreviations, the courses of study in chemistry and physics and need particular explanation. Briefly, the length of each course in point of time is represented by a letter, and the character of the course, by a numeral. The letters employed have the following meanings, a "year" being the usual "academic year" of nine or ten months:

A. Four years.
B. Three and a half years.
C. Three years.
D. Two and a half years.
E. Two years.
F. One and two-thirds years.
G. One and a half years.
H. One and one-third years.
I. One year.
J. Three-fourths of a year.
K. Two-thirds of a year.
L. One-half year—from sixteen to twenty weeks. (Under this heading are put the usual medical school courses of five months.)
M. One-third year.
N. Less than one-third year.
O. Length of course unstated, but not over a year.

The numerals which represent the characters of courses are according to the subjoined schedule:

CHEMISTRY.

Column 10.—1. Full course of general and analytical chemistry, including higher organic chemistry and original research.
2. Ditto, with less organic chemistry, little research, and special attention to applied chemistry.
3. Ditto, with special reference to mining and metallurgy. (Includes assaying.)
4. Ditto, with special reference to agriculture.
5. Full course in general and analytical chemistry, followed by special instruction in medical or physiological chemistry.
6. Course in general chemistry, with qualitative and quantitative analysis.
7. Course in general chemistry, with qualitative analysis.
8. Course in general chemistry, with elementary laboratory work.

Column 10.—9. Course in general chemistry, with experiments by the teacher, but no regular laboratory work for pupils.
10. Elementary oral instruction, with experiments by the teacher.
11. Elementary text book work, without experiments.
12. Elementary oral instruction, without experiments.
13. Supplementary course in blowpipe analysis.
14. Supplementary course in assaying.
15. Supplementary course in toxicology.
16. Supplementary course in urine analysis.
17. Supplementary course in medical chemistry, with laboratory work.
18. Supplementary course in medical chemistry, without laboratory work.
19. Supplementary course in agricultural chemistry, with laboratory work.
20. Supplementary course in agricultural chemistry, without laboratory work.

PHYSICS.

Column 11.—1. Full course, including higher mathematical physics, advanced laboratory work, and research.
2. Full course, with mathematical physics and elementary laboratory work.
3. Course in general physics, involving a previous knowledge of trigonometry, and including laboratory work.
4. Ditto, with experiments by the teacher, but no laboratory work.
5. Ditto, without experiments.
6. Course in elementary physics, with laboratory work.
7. Ditto, with class experiments, but no laboratory work.
8. Elementary oral instruction, with experiments by the teacher.
9. Elementary text book work, without experiments.
10. Elementary oral instruction, without experiments.
11. Supplementary course in mechanics.
12. Supplementary course in thermodynamics.
13. Supplementary course in chemical physics.
14. Supplementary course in medical physics.

The classification thus given is by no means perfect, but it suffices very well for all practical purposes. In most cases it applies quite accurately; in none does it seem to be misleading. Whenever an institution gives an unusual or remarkable course in chemistry or physics, the small letter "t" affixed to the abbreviations refers back to the detailed description given in the text of one of the preceding chapters.

It is important to state that in very many instances the length of courses of study was not reported. In all cases a letter indicates the total length of both optional and elective courses. So, also, a numeral shows the maximum undergraduate course in each science offered by a given institution. For example, although Harvard University requires of its undergraduate students attendance upon only a short course of chemical lectures, it offers nearly four years of advanced study in analysis, research, &c. Hence the abbreviation used is employed upon the principle that the greater includes the less.

One point remains to be noted in connection with the medical schools. In the majority of such institutions the session is only about five months in duration. The students are required to attend two courses of lectures upon chemistry, covering two such sessions; but as the second course is merely a repetition of the first I have in general credited such medical schools with only half a year, or one session, of chemical study.

Column 12.—This column is important, but not as important as it may seem to be at first thought. The value of apparatus is to a certain extent an indication of the

facilities for doing scientific work, although at the same time it may be a misleading one. The cost of instruments is by no means a true index of their efficiency. For school purposes, ten thousand dollars' worth of appliances for showing lecture experiments is of less real value than a good laboratory outfit accessible to students and costing but one-twentieth of the sum. Again, the values reported in this column are necessarily somewhat ambiguous. A given sum of money expended in apparatus directly imported from Europe will buy a great deal more than the same amount laid out at a local dealer's establishment. Finally, the values given are usually estimates, and as such are more liable to err in the direction of excess than in that of deficiency.

Columns 13 *and* 14.—In these the text books used by the various institutions are indicated by numbers. The latter are given in the catalogue of text books, which immediately precedes this explanation. This catalogue is not an attempt at complete bibliography. It is merely a list of the works actually reported as being in use for class purposes, exclusive of those which were returned as "books of reference." Perhaps twenty text books were added to the list, which, though not reported as actually in use, were likely to be adopted at any time by some school or other. In most cases publishers' names are given, but in a few instances text books were recorded concerning which the regular bibliographic catalogues are absolutely silent. Such books were probably printed for authors directly, and were never systematically put into trade circulation.

The two columns in question are among the most suggestive in the table. In the majority of cases the selection of inferior text books implies the doing of inferior work. The exceptions would only be those instances in which a good teacher is not permitted to make his own selections, but is bound by the choice of some school committee or board of trustees.

In a good many cases text books have been ambiguously reported. For example, "Ganot" is frequently returned as the author used in the study of physics. This may mean either the larger Atkinson's Ganot issued by William Wood & Co., the smaller "popular" work published by Appleton, or the edition known as Peck's Ganot. The differences between these several works are certainly important, and an accurate discrimination would have been most desirable. There are other analogous cases in which similar confusion was unavoidable.

Columns 15 *and* 16.—These columns hardly require comment. The accuracy of the figures reported in them is not always unquestionable. They have, however, in general a moderate historical value. In important cases they are supplemented by text in the preceding chapters.

TABLE I.—*Statistics of instruction in*

City.	Average age of pupils beginning these studies.	Courses below high schools.		Courses in high schools.	
				Chemistry.	
		Chemistry.	Physics.	Course of study.	Number of exercises a week.
1	2	3	4	5	6
Montgomery, Ala	13–15			9 or 11	5
Oakland, Cal	16			9	
San Francisco, Cal	15–17			L 8 t	5
Denver, Colo	15			K. 8	5
Bridgeport, Conn	16	None	None	K. 8	5
Hartford, Conn	16–17	None	None	K. 8	5
Meriden, Conn		None		None	
New Haven, Conn	16			8	
Norwich, Conn		None	None	None	
Stamford, Conn	15			None	
Wilmington, Del	15			L 8	3
Jacksonville, Fla	14			L. 11	5
Atlanta, Ga	16			L 9	5
Augusta, Ga	14			I. 11	3–4
Columbus, Ga	15–16			L 9	5
Macon, Ga	14			None	
Savannah, Ga	15–16			K. 11	3
Alton, Ill	14	None	None	L. 9	5
Belleville, Ill	11–12			None	
Bloomington, Ill	16–17	None	None	M. 9	5
Chicago, Ill	14½–15½	None	None	L 8	
Decatur, Ill	16–17			K. 9	5
Freeport, Ill	17			None	
Galesburg, Ill	15			M. 9	4
Jacksonville, Ill	11–16		Oral	L. 8	5
Peoria, Ill	17			K. 8	5
Quincy, Ill	17			L. 8	5
Rockford, Ill	15			L. 9	5
Rock Island, Ill	16			M. 9	5
Fort Wayne, Ind	17–19			J. 7 t	5
Indianapolis, Ind	14½–17			M. 8	5
Jeffersonville, Ind	16			L. 11	5
Lafayette, Ind	16–16½			L. 8 t	5
Logansport, Ind	16–18	None	None	L. 7 t	5
Madison, Ind	17½			L. 8	5
Richmond, Ind	17			K. 7 t	5
South Bend, Ind	15			L. 7 t	3
Terre Haute, Ind	17–18			N. 9	5
Burlington, Iowa	14½	None	I	J. 8	5
Council Bluffs, Iowa	15–16			K. 9	5
Davenport, Iowa	16–17½			K. 8	5
Des Moines, Iowa	18			K. 7 t	4
Dubuque, Iowa	13–15	None	G	L. 9	5
Keokuk, Iowa	15–17			L. 9	5
Atchison, Kans	16½			L. 11	5
Lawrence, Kans	16			None	
Leavenworth, Kans		None	I. 8 or 10 ?	J. 8	5
Covington, Ky	17	None		L. 9	5
Lexington, Ky		None	None	None	
New Orleans, La	14½–15*	None	L. 7	K. 8	
Augusta, Me	14–15			L. 8	4
Biddeford, Me	15	None	None	L. 9	5
Lewiston, Me	15–16			L. 7	4
Portland, Me	14½			8	
Baltimore, Md	14–18			E. 9, City College	
Adams, Mass	15			K. 9	
Boston, Mass	11–12	None	C. 7	High school, L. 8 t; Latin school, none.	
Cambridge, Mass	16			M. 9	
Chicopee, Mass	16			M. 9	4–5
Fall River, Mass	16–16½			L. 9	4
Fitchburg, Mass	16–18			K. 7	4
Haverhill, Mass	16			I. 8 t	5
Holyoke, Mass	16			9	

* About. † With apparatus. ‡ Before.

chemistry and physics in city public schools.

Courses in high schools. — Physics. — Course of study.	Number of exercises a week.	Approximate value of chemical and physical apparatus.	Text books used. — Chemistry.	Text books used. — Physics.	Instruction began. — Chemistry.	Instruction began. — Physics.
7	8	9	10	11	12	13
....	....	....	190........	....	*1876	......
7........	....	$250	190........	45........	1869	1869
I. 7........	5	1,000–2,000	141........	41........	1856	1856
I. 7........	5	1,000	141........	32........	....	......
K. 7........	5	400	141........	83........	1876	1876
K. 7........	5	6,000	124........	32........	1847	1847
....	....	....	....	....	....	......
7........	....	2,000–3,000	190........	7........	†1872	†1872
None	....	....	....	....	....	......
7........	....	100	....	53........	....	......
I. 7........	5	800	141........	32........	*1873	*1867
L. 9	5	....	190........	45........	....	......
I. 7........	5	1,000	204........	45........	1871	1871
E. 9	3–4	None	190........	45, 326........	*1873	*1873
I. 7........	5	600	190........	45........	1871	1871
K. 9........	4	None	....	46........	....	1878
K. 9........	4	None	190........	45........	1869	1869
L. 7	5	100	190........	7........	*1867	*1867
7........	3	800	....	38........	....	1873
L. 7	5	150	190........	7........	1869	1859
I to E. 7	3–5	1,500	141........	2, 32........	1856	1856
K. 7........	5	250	204........	45........	1868	1866
L. 7	5	300	....	53........	....	*1859
M. 7........	4	100	190........	45........	1871	1871
L. 7	5	300	182........	41........	1867	1867
L. 7	5	475	141........	39........	1859	1859
7........	....	500	190........	45........	1864	1864
L. 7	5	150	204........	7........	1854	1854
M. 7........	5	50	190........	45........	1872	1872
J. 7	5	1,200	141, 223........	38........	1863	1863
L. 7	5	500	141........	33........	1869	1869
I. 9	5	15	157........	53........	1870	1870
L. 7	5	1,500	141........	41........	1864	1864
L. 6	5	1,000	190........	45........	1871	1871
L. 7	5	250	190........	45........	*1850	*1850
K. 6........	5	1,000	190........	45........	1869	1869
L. 7	4	500	141, 233........	45........	1877	1864
K. 7........	5	175	137........	32........	....	......
L. 7	5	1,500	204........	324........	‡1869	‡1869
I. 7........	5	550	204........	32........	1860	1869
K. 7........	5	400	157........	39........	1865	1865
K. 7........	4	300	204........	33........	1872	1872
I. 7........	5	500	204........	18, 32........	1867	1867
L. 7	5	300	157........	7........	1873	1873
L. 9	5	None	190........	46........	....	......
L. 9	5	None	....	46........	....	1871
J. 7	5	2,000	188........	32........	1869	1869
I. 7........	5	600	190........	32, 33........	1866	1866
None	....	....	....	....	....	......
K. 7........	....	500	190........	29, 45........	1854	1854
I. 7........	4	100	141........	33........	....	......
I. 7........	5	125	190........	45........	1848	1848
K. 7........	4	300	182, 185........	33........	....	......
I. 7........	....	700	190........	83........	....	......
E. 7, City College........	....	3,000	124, 183........	2........	1835	1835
K. 7........	....	400	141........	33........	....	......
High school, I. 7; Latin school, L 9.	....	§1,500	....	1, 7, 32........	§1869	§1828
K. 7........	....	5,000	182........	41........	....	......
K. 7........	4–5	500	141........	33........	....	......
L. 7	4	300	190........	46........	‖1859	‖1859
J. 7	5	1,000	190........	39........	....	......
I. 7........	5	600	141........	42........	‖1864	‖1804
7........	....	200	190........	45........	*1865	*1865

§ High school.

‖ Early as.

TABLE I.—*Statistics of instruction in chemistry*

City.	Average age of pupils beginning these studies.	Courses below high schools.		Courses in high schools.	
				Chemistry.	
		Chemistry.	Physics.	Course of study.	Number of exercises a week.
1	2	3	4	5	6
Lawrence, Mass	16			H. 8	5
Lowell, Mass	14½–15½	None	None	I. 7	5
Lynn, Mass	16	None	None	K. 9	4
Marlboro', Mass	16			K. 9	4
Newburyport, Mass	13–14			I. 9	4
Newton, Mass	13½–16½			L. 7	5
Northampton, Mass	16			M. 9	5
Salem, Mass	15–17			E. 7	3
Somerville, Mass	16–17	None	None	I. 8	3
Springfield, Mass	15½–16½	Taught orally.	Taught orally	K. 9	4
Taunton, Mass	16			L. 9	4
Weymouth, Mass	15–16			L. 9	5
Woburn, Mass	16–18			I. 8	
Worcester, Mass	16–17			I. 7 t	4–5
Adrian, Mich	17			I. 7	
Ann Arbor, Mich	14	M. 9	M. 7 or 9	M. 9	5
Bay City, Mich	14–16			I. 8	5
Detroit, Mich	17½–18			L. 9	5
East Saginaw, Mich	15			L. 9	5
Grand Rapids, Mich	16½–17½			K. 8	5
Saginaw, Mich	15–17			L. 9	5
Minneapolis, Minn	16–18			K. 9	4½
St. Paul, Minn	14–15	None	Taught orally	I. 9	5
Natchez, Miss	14			I. 9*	3
Hannibal, Mo		None	None	None	
Kansas City, Mo	16			L. 8	5
St. Joseph, Mo	13–16		I. 9	N. 9	5
St. Louis, Mo	17		10	I. 9	2
Omaha, Nebr	15			I. 7	2–5
Concord, N. H	1[illegible]	Taught orally.	Taught orally	M. 9	5
Manchester, N. H	14½	None	None	I. 7	4
Nashua, N. H	14–16			I. 7	5
Portsmouth, N. H	15	None	None	K. 9	3
Elizabeth, N. J	14–15			None	
Jersey City, N. J	14–15	Taught orally.	Taught orally	L. 9	5
New Brunswick, N. J	16			L. 9	3–4
Orange, N. J	15			M. 9	3–4
Paterson, N. J	16			9	
Trenton, N. J	17			L. 9	2
Albany, N. Y	15½–16½			L. 9	5
Auburn, N. Y	16–17			L. 9	5
Binghamton, N. Y	15½			M. 8	5
Brooklyn, N. Y				9	3
Cohoes, N. Y	15			9	
Elmira, N. Y	17		Oral primary	L. 9	5
Ithaca, N. Y	15			L. 8	
Lockport, N. Y	15			K. 9	5
Newburgh, N. Y	15			9	
New York, N. Y	13	None	L. 10, twice a week		
Ogdensburg, N. Y	15	None	I. 9, 5 times a week		
Rochester, N. Y	15–16			M. 8	4
Saratoga Springs, N. Y	15			M. 9	4
Schenectady, N. Y	17–18			M. 9	5
Syracuse, N. Y	15–16			L. 8	5
Troy, N. Y	16–17	None	None	I. 9	4
Utica, N. Y	17–18			J. 9, Free Acad	4
Yonkers, N. Y	15			9	3
Akron, Ohio	16½–17			M. 9	5
Canton, Ohio	16			K. 9	5
Chillicothe, Ohio	13			K. 9	5
Cincinnati, Ohio	17			8 t	
Cleveland, Ohio	16–17			I. 8 t	4
Columbus, Ohio	13½–17		I. once a week	J. 8	

*About   †Early as.

and physics in city public schools—Continued.

Courses in high schools. Physics. Course of study.	Number of exercises a week.	Approximate value of chemical and physical apparatus.	Text books used. Chemistry.	Physics.	Instruction began. Chemistry.	Physics.
7	8	9	10	11	12	13
7	5	$515	141	33		
I. 7	5	2,000–2,500	141, 190, 241	1, 32	*1829	*1829
K. 7	4	500	204	32	*1855	*1855
K. 7	4	300	190	46	*1869	*1869
I. 7	4	500	190	46	†1825	†1825
I. 7		2,500	157	30	1858	1858
K. 7	5	25	182	39	‡1854	‡1854
L. 7	3	1,000	141	39	*1830	*1830
I. 7	3	800	141, 184	39, 41		
L. 7	4	3,500	141	33	†1830	†1850
L. 7	4	500	157	2	1849	1849
K. 7	5	150	190	33	*1855	*1855
I. 7	5	1,000	141	38	1852	1852
I. 6	4–5	2,250	141	33	*1855	*1855
7		2,500	141	7	†1859	†1859
K. 7	5	800	141, 183, 184	32, 47, 48	1856	1856
I. 7	5	1,200	190	41	*1870	*1870
I. 7	5	3,500	157, 168, or 182	32	*1854	*1854
K. 7	5	500	190	7	1875	1860
I. 7	5	2,500	141	41	*1861	*1861
L. 7	5	600	204	32	*1860	*1860
I. 7	4⅗	1,000	141	2		
I. 7	5	450	141	32	1867	1867
I. 7	3	500	161	39		
None						
I. 7	5	1,600	124	32	1867	1867
J. 7	5	200	184	15, 41	1860	1868
I. 7		200	122	32	1859	1859
F. 7	2–5	1,100	204	32	{ 1872 { 1873	} 1859
K. 7	5	500	190	33	†1859	†1859
K. 7	4	1,000	140, 204	32	1870	1860
K. 7	5	3,000	190, 235	46	*1859	*1859
I. 7	4	200	204	39		
E. 9	5	Slight		2, 46	§1875	1874
L. 7	5	500	182	41		
K. 7	4	100	190	7	*1854	*1854
K. 7	4	150	190	45	*1875	*1872
7		100	141	42		
L. 7	5	200	137	53	1876	1876
K. 7	5	1,500	137	7	1869	1869
J. 7	5	350	190	45	1866	1868
K. 7	5	1,600	183	32	1867	1867
7	3					
7		250	137	7	1873	1873
L. 7	5	1,000	190	46	1861	1861
L. 7		800	190	41		
K. 7	5	1,000	204	41	1848	1848
7		300	182	41	†1869	†1869
			None used	None used		1855
		Nothing		45		
K. 7	4	3,500	190	53	*1859	*1859
I. 7	4	200	190	38	1872	1869
K. 7	5	500	182	41	1854	1854
L. 7	5	3,000	190	46	†1869	†1869
I. 7	4	800	137	7	*1850	*1850
J. 7 Free Acad	4	1,425	204	45	1854	1854
9	3	25	137	7		
L. 7	5	200	190	7	†1855	†1855
K. 7	5	150	204	33	†1867	†1867
K. 7	5	200	190	39	*1859	*1859
7		3,500	183	32	1841	1841
H. 7	2–3	3,000–4,000	141	2	1846	1846
J. 7		2,000	141	47, 48, with 17	1849	1849

‡ Probably. § Discontinued.

TABLE I.—*Statistics of instruction in chemistry*

City.	Average age of pupils beginning these studies.	Courses below high schools.		Courses in high schools.	
				Chemistry.	
		Chemistry.	Physics.	Course of study.	Number of exercises a week.
1	2	3	4	5	6
Dayton, Ohio	15–17			L. 9	5
Hamilton, Ohio	12		Taught	None	
Mansfield, Ohio	15–17½			L. 8	5
Newark, Ohio	16			L. 8	5
Portsmouth, Ohio	15–16			K. 8	5
Sandusky, Ohio	16–18			L. 8	
Springfield, Ohio	15–16			K. 9	
Steubenville, Ohio	16			9	
Zanesville, Ohio	16			8	
Portland, Oreg	15–17			L. 8	5
Allegheny, Pa	15½			None	
Allentown, Pa	15–17			K	5
Altoona, Pa	14			None	
Carbondale, Pa	16			9	
Chester, Pa	15			None	
Danville, Pa	16			L. 11	5
Easton, Pa	9	None	Text book 323	None	
Erie, Pa	14		Taught orally	L. 8	4
Harrisburg, Pa	13	Elementary	Elementary	8	4
Lancaster, Pa		None	None	None	
New Castle, Pa	16–17			L. 9	5
Norristown, Pa	15			L. 9	5
Pittsburgh, Pa	16–17		Elementary	I. 7 t	5
Reading, Pa	15½–16½			9	
Scranton, Pa	14–16			M	5
Titusville, Pa	12–15		Elementary	K	4
Wilkes-Barre, Pa	14			K. 9	
Williamsport, Pa	14			L. 9	
York, Pa	14–16	Elementary	Elementary	K. 6	5
Newport, R. I	16–17			E. 7 t	3
Providence, R. I	15			L. to J. 8	5
Chattanooga, Tenn	17			None	
Knoxville, Tenn	14½			M. 11	5
Memphis, Tenn				11	
Nashville, Tenn	15			I. 9	4
Houston, Tex		None	None	None	
Burlington, Vt	15–16			M. 9	5
Alexandria, Va		None	None	None	
Lynchburg, Va	15–16			L. 8	3
Norfolk, Va	14		Oral twice a week		
Petersburg, Va		None	None	None	
Portsmouth, Va		None	None	None	
Richmond, Va	15			9	
Fond du Lac, Wis	15–16			L. 9	5
Janesville, Wis	16			L. 9	5
La Crosse, Wis	16			M. 8	5
Madison, Wis	16–17			K. 8	5
Milwaukee, Wis	17			J. 8	5
Racine, Wis	16			None	
Washington, D. C	10		C. oral once a week		

* About. † Before.

and physics in city public schools—Continued.

Courses in high schools. Physics. Course of study.	Number of exercises a week.	Approximate value of chemical and physical apparatus.	Text books used. Chemistry.	Text books used. Physics.	Instruction began. Chemistry.	Instruction began. Physics.
7	8	9	10	11	12	13
I. 7	5	$200	141	32	*1855	*1855
7	5	50	None	41	....	.....
I. 7	5	500	204	2	....	.....
I. 7	5	250	124	32	1860	1860
K. 7	5	150	190	45	*1856	*1856
I. 7	....	250	137	39	†1845	†1845
K. 7	....	250	190	7	1854	1854
7	....	300	137	7	....	.....
7	....	....	190	45	....	.....
L. 7	5	200	190	45	*1874	*1874
L	5	....	....	7	....	.....
I	5	25	157	32	‡1865	‡1865
I. 7	5	100	....	7	....	*1870
7	....	200	190	45	....	.....
I. 7	5	150	....	45	....	*1871
J. 9	5	Nothing	190	324	*1871	*1871
I	....	....	....	323, 324	1859	1859
L. 7	4	600	190	45	1869	.....
7	4	300	204, 324	39, 324	....	.....
None	....	....	....	....	....	.....
L. 7	5	50	190	45	....	.....
I. 7	4	300	190	45	*1854	*1854
I. 6	5	2, 500	137, 295	41, 117	§1873	§1873
7	....	500	190	45	1852	1852
M	5	....	190	45	*1870	*1870
K	4	60	137	7, 323	*1871	*1871
I. 7	....	100	190	7, 45	1870	1870
J. 7	....	700	190	32	*1869	*1869
K. 7	5	500	124	38	1870	1870
I. 7	2	500–600	183, 219, 225	13, 14, or 38 ?	1873	1873
J. 7	5	2, 000	120, 141, 204	2	1843	1843
I	....	....	....	39	....	1878
M. 9	5	Nothing	190	45	1878	1876
7	....	....	145, 204	39	....	.....
I. 7	4	500	324	39	1858	1858
None	....	....	....	....	....	.....
M. 7	5	200	190	45	1871	1871
None	....	....	....	....	....	.....
L. 9	3	Nominal	190	45	1873	1873
....	....	Nothing	....	38	....	1873
None	....	....	....	....	....	.....
None	....	....	....	....	....	.....
7	....	1, 000	190	45	....	.....
L. 7	5	600	204	32	1859 1861	1859 1861
L. 7	5	200	190	45	1864	1864
K. 7	5	500	190	32	*1872	*1872
K. 7	5	800–1, 000	175	32	....	.....
J. 7	5	1, 200	141	47	1868	1868
I. 7	5	300	....	2	....	*1859
I. 7	2	200	....	38	....	1873

‡ Early as.

§ Laboratory.

TABLE II.—*Statistics of instruction in chemistry and physics in secondary schools, normal cultural colleges, schools of science, and in*

Name of institution.	Post office address.	No. of teachers. Number in chemistry.	No. of teachers. Number in physics.	Total number for both branches.	Do these teachers instruct in other subjects?	Grade of the course in which these studies are begun. Chemistry.	Grade of the course in which these studies are begun. Physics.
1	2	3	4	5	6	7	8
DARY SCHOOLS.							
Dadeville Female Institute	Dadeville, Ala	1	1	1	Yes.	Grammar sch.	Grammar sch.
Green Springs School	Green Springs, Ala	1	1	1			
Talladega College	Talladega, Ala	1	1		Yes	Higher normal	Higher normal
Park High School	Tuskegee, Ala						
Gilroy Seminary	Gilroy, Cal	0	1	1			
Napa Collegiate Institute	Napa, Cal	1	1	1	No	2d year	2d year
California Military Academy	Oakland, Cal	1	1	2	Yes.		
Golden Gate Academy	Oakland, Cal	1	1	2	Yes.	Middle grade	Middle grade
Placerville Academy	Placerville, Cal	1	1	2	Yes.	1st academic	1st academic
Sacramento Select School	Sacramento, Cal	1	1	1	Yes		
Point Loma Seminary	San Diego, Cal	0	1	1			
Sacred Heart College	San Francisco, Cal	1	4	4	Yes.	4th grade	4th grade
Urban Academy	San Francisco, Cal	1	1	1	Yes	Senior	Senior
Laurel Hall	San Mateo, Cal						
School of the Holy Cross	Santa Cruz, Cal	1	1		Yes		
Bethany Academy	Bethany, Conn	1	1	2	No		
Home School for Girls	Bethlehem, Conn	1	1	1			
Commercial and Military Institute.	Bridgeport, Conn	1	1	1			
Golden Hill Institute	Bridgeport, Conn						
Hillside Seminary	Bridgeport, Conn	1	1	1	Yes.		
Durham Academy	Durham, Conn	0					Academy
Greenwich Academy	Greenwich, Conn	1	1	1	Yes		
Kent Seminary	Kent, Conn						
Mystic Valley English and Classical Institute.	Mystic Bridge, Conn.	1	1	1	Yes.	3d year	3d year
New Britain Seminary	New Britain, Conn	1	2	2	Yes.		
Collegiate and Commercial Institute.	New Haven, Conn	2	2	2	Yes		
Miss Nott's School	New Haven, Conn	1	1	1	Yes.	2d year	2d year
Bulkeley School	New London, Conn				Yes	2d year	2d year
Fitch's Home School for Young Ladies and Boys.	Noroton, Conn	1	1	1	No		
Norwich Free Academy	Norwich Conn	1	1	1	Yes.	3d year	3d year
Stratford Institute	Stratford, Conn	1	1	2	Yes.	Senior	Senior
Connecticut Literary Institute	Suffield, Conn	1	1	1	Yes.	3d year	2d year
Oak Hill Ladies' Seminary	West Haven, Conn	1	1	1	Yes		
Parker Academy	Woodbury, Conn	1	1	1	Yes.		
Wilmington Conference Academy.	Dover, Del	1	1	1	Yes.		
Felton Seminary	Felton, Del	1	1	1	Yes.	Last grade	Last grade
Milford Academy	Milford, Del		1	1	Yes.		
Wyoming Institute of Delaware	Wyoming, Del	1	1		Yes.	2d year	2d year
Cookman Institute	Jacksonville, Fla	0	1	1	Yes		
Graded Free School	Milton, Fla	1	0	1	Yes.		
Richmond Academy	Augusta, Ga	1	1	1	Yes.	Senior	Senior
Grooverville Academy	Boston, Ga		1	1			
Butler Female College and Male Institute.	Butler, Ga	1	1	1	Yes.	Junior	Junior
Paris Hill Academy	Cameron, Ga						
Carroll Masonic Institute	Carrollton, Ga	0	1	1	Yes		Second
Hearn Manual Labor School	Cave Spring, Ga						3d grade
Slade's School for Boys	Columbus Ga	0	1	1			
Grange Institute	Cuthbert, Ga	1	1	2	Yes	Junior	Sophomore
South Georgia Male Institute	Dawson, Ga	1	1		Yes.	Highest	Highest
Mount Paran Academy	Euharlee, Ga	1	1	2	Yes	3d or highest	3d or highest
Fairburn Academy	Fairburn, Ga	1	1	1	Yes.		
Martin Institute	Jefferson, Ga	1	1	1	Yes.	Junior	Junior
Adams' Practical School	Linton, Ga				Yes	Intermediate	Intermediate
Forest Home Institute	Madison, Ga	1	1	1	Yes.	1st Junior	1st Junior

schools, institutions for the superior instruction of women, universities and colleges, agri- schools of medicine, dentistry, and pharmacy.

Course of study. Chemistry.	Course of study. Physics.	Average age of pupils beginning these studies.	Approximate value of chemical and physical apparatus.	Text books used. In chemistry.	Text books used. In physics.	Instruction began. Chemistry.	Instruction began. Physics.
9	10	11	12	13	14	15	16
11	9	12–21	$10	190	45		
9	7	12–20	1,500	Various elementary works.	Various elementary works.	1847	1847
8	7	20	150	190	45	1879	1876
11	7			190	39		
None	9		100		41		
7	7	18	3,000	133, 182, 212, 233		*1877	
8	7	17		190	45	1865	1865
9	7	15	100	141	39		
9	9	17–19	25	190	39	1861	1861
12	10						
None	7	15–16	125		45		
9		14		190	38		
11	9	16			32		
11	9			190	45		
	9	14			45	1877	1877
8	7	14	4,000		39	1874	1874
9	7	16		124			
11	9	15					
None	None						
		17		182	41		
None	7	15	150		39		†1842
8	6	14	1,200	140, 190	7	†1829	†1829
None	None						
8	7	16	600	182, 190	38, 45	1868	1868
9	7	15		178, 190	28, 45		
				140	38		
9	7	16–17		141	38		
		16		190	45		1873
9	7	14					
8	7	15	1,500	141	39	1855	1855
9	7	16		190, 204	45, 53		
K. 7	K. 7	18		120, 140, 223	2, 13		
9	7	18	300	141?	41		
11	9	15		141		1879	
9	7	10	100	141	38	1874	1874
11	9	15–16	Nothing	184	38, 39, 45, 48	‡1867	‡1867
		16		190	45	1878	1878
9	7	16	$500	178, 190	38, 39	1870	1870
None	9	15			39		1876
K. 11	None	17	Nothing	190		1878	
I. 7	E. 7	12–16		190	38, 45	†1865	†1865
11	9	15	Nominal	190	45	1873	1873
None	9				53, 322		
None	9	16			13, 14, or 38?		1852
None	9	16	Nothing		53		
None	7	15–17	$300		39		
11	9	18	Nothing	190	45	†1870	
11	9	16	Small	135	39		
11	9	16	Nothing	135, 190	6, 38, 45	1870	1870
11	9	15	Nothing	190	45	1877	1877
11	9	16–18		138 or 204	13, 14, or 38?	1830	1830
8	7	12–15	$50–75	Reference books only	Reference books only	1858	1858
9	7	14–15		190	45	1840	1840

* Laboratory. † About. ‡ Probably.

TABLE II.—*Statistics of instruction in chemistry*

Name of institution.	Post-office address.	No. of teachers. Number in chemistry.	Number in physics.	Total number for both branches.	Do these teachers instruct in other subjects	Grade of the course in which these studies are begun. Chemistry.	Physics.
1	2	3	4	5	6	7	8
SECONDARY SCHOOLS—Cont'd.							
Marietta High School	Marietta, Ga				Yes		
Marshallville High School	Marshallville, Ga	1	1	1	Yes	Sophomore	Sophomore
Perry Male School	Perry, Ga	1	1	1	Yes	Highest	Highest
Rabun Gap High School	Rabun Gap, Ga	1	1	1	Yes	9th grade	9th grade
Rome Male High School	Rome, Ga	1	1	1	Yes	4th year, h. s	4th year, h. s
Shorter College	Rome, Ga	1	1	1	Yes	Sophomore	Sophomore
Sylvania Academy	Sylvania, Ga		1	1	Yes		
Collinsworth Institute and Levert College.	Talbotton, Ga	1	1	1	Yes	Senior	Senior
Thomson High School	Thomson, Ga	1	1	1			
Walthourville Academy	Walthourville, Ga	2	2	2	Yes	Academic	Academic
Washington Female Seminary	Washington, Ga	1	1	1	Yes	High school	High school
Washington Male Academy	Washington, Ga					Sophomore	Sophomore
Sumach Academy	Woodlawn, Ga	1	1	2	Yes		
Aledo Academy	Aledo, Ill	0	1	1	Yes		
Allen Academy and Polytechnic Institute.	Chicago, Ill. (663 Michigan ave.).	1	1	2	Yes	Academic	Academic
Chicago Ladies' Seminary	Chicago, Ill		1	2	Yes	3d year	3d year
Howe Literary Institute	East Saint Louis, Ill		2	2	Yes	2d year	1st year
Northern Illinois College	Fulton, Ill		1	1	Yes	Senior	Senior
Lake Forest Academy	Lake Forest, Ill		1	1	Yes	Academic	Primary
Morgan Park Military Academy	Morgan Park, Ill. (Wash. Heights).		1	1	Yes	3d year, acad	3d year, acad
Rock River Seminary	Mt. Morris, Ill		1	1	No	Grammar	Grammar
Grand Prairie Seminary and Onarga Commercial College.	Onarga, Ill	1	1	2	Yes		
Edgar Collegiate Institute	Paris, Ill	1	1	2	Yes		
Chaddock College	Quincy, Ill	1	1	1	Yes	Freshman	Freshman
Friends' Bloomingdale Academy	Bloomingdale, Ind	1	1	1	Yes	Academic	Academic
Barnett Academy	Charleston, Ind	1	1	1	Yes		
St. Augustine's School	Fort Wayne, Ind			1			
Spiceland Academy	Spiceland, Ind	1	1	1	Yes	2d year, h. s	1st year, h. s
Academic Department of Vincennes University.	Vincennes, Ind	1	1		Yes	Senior	Junior
Waveland Graded School	Waveland, Ind	1	1	1	Yes	High school	High school
Ackworth Institute	Ackworth, Iowa		1	2	Yes		
Birmingham Academy and Boarding School.	Birmingham, Iowa		1	1	Yes	Third	First
Blairstown Academy	Blairstown, Iowa		1	1	Yes	College prep	College prep
Graff's School	Burlington, Iowa		1	1	Yes		
Friends' Select School	Coal Creek, Iowa	0	1	1	Yes		
Epworth Seminary	Epworth, Iowa		1	2	Yes	4th year	2d year
Grinnell Academy	Grinnell, Iowa	0	1	1	Yes		
St. Agatha's Seminary	Iowa City, Iowa	2	1	3	Yes	Academic	Academic
Riverside Institute	Lyons, Iowa	1	1	1	Yes	Primary	Primary
New London Academy	New London, Iowa						
Hazel Dell Academy	Newton, Iowa	1	1	1	Yes		
Cedar Valley Seminary	Osage, Iowa	1	1	1	Yes		
Tilford Academy	Vinton, Iowa	0	1	1	Yes		Preparatory
Nazareth Academy	Near Bardstown, Ky	2	2	2	Yes		
Alexander College	Burkesville, Ky	1	1	2	Yes	Senior	Middle
Greenwood Seminary	Frankfort, Ky						
Sayre Female Institute	Lexington, Ky	1	1	1	Yes	3d year	2d year
German and English Academy	Louisville, Ky	1	1		Yes	Academic	Academic
Maysville Seminary	Maysville, Ky	1	1	1	Yes		
Minerva Male and Female College.	Minerva, Ky	1	1	1	Yes		
Henry Male and Female College	New Castle, Ky	1	1	1	Yes	Sophomore	Sophomore
Browder Institute	Olmstead, Ky	1	1	1	Yes		
Bath Seminary	Owingsville, Ky						
Paducah Female College	Paducah, Ky	1	1	1	Yes	3d year	2d year
Princeton College	Princeton, Ky	1	1	1	Yes	2d collegiate	3d collegiate

and physics in secondary schools, &c. — Continued.

Course of study.		Average age of pupils beginning these studies.	Approximate value of chemical and physical apparatus.	Text books used.		Instruction began.	
Chemistry.	Physics.			In chemistry.	In physics.	Chemistry.	Physics.
9	10	11	12	13	14	15	16
11	9	15		190	39		
11	9	16		204	45	1878	1876
11	9	17		190	45		
I. 11	I. 9	18	Nothing	204	39	1873	1873
11	9	16	$15-25	190	45	1871	1871
8	7	15	1, 200	190	45	1878	1878
	7	15			45		1878
9	7	16	700	190	45		
		15-16		197	35		
11	9	14		190	53		
11	9	14-18	Nothing	141	45		*1839
		15	Nothing	204	53		
11	9	16	Nothing	204	39	1869	1869
None	9				32, 39		1873
9	7	16	$500			1874	1874
9	7	18		190	2		
L. 9	L. 7	15		137	7	1874	1874
7	7	18	500	190	45	1867	1867
9	7	16-18	800	141	32	1859	1859
9	7				2, 7, 38		
		15	200				
9	7	18	400	204	53	1865	1865
9	7			204			
11	7	16	50	182	41		
9	7	18	100	183 or 190	38	*1847	*1847
11	9			157, 190	39, 323		
11	9			197	53		
K. 7	K. 7	18	300	190, 235		1867	1867
K. 8	K. 7	17-18	400	190	45	1872	1872
9	7	18	300	197	53		
K.	L.	17	40	157, 183		1868	1868
11	9	17-18		190	45, 328	1864	1864
11	9	16	5	190	45	1868	1868
		15		178	37		
None		16	Nothing		39		
K. 9	K. 7	17	$100	204	32, 47	*1864	*1864
None	M	16			7		
E. 8	I. 7	16		190	45		
9	7	9-22	700	157	39, 323		
None	None		Nothing				
I	I	18		204	2	1856	1856
K. 9	K. 7	18	$100	162, 182	38, 63	1863	1863
None	9	18	Nothing		39, 39		
9	7	15-16	$3, 000	161	32	1822	1822
11	9	15-16		190	37	1870	1870
11	9			190	45		
9	7	15-16	300	190	46	*1854	*1854
10	8	15	300	None used	None used		
9	7	16	150	157, 190, 204	45	1854	1854
I. 8	I. 7	17	5, 125	124, 141, 183	13	1861	1861
11	9	15-16	10-15	190	45		
11	9	15	Nothing	178, 190, 197	39, 45		
				190	45		
I. 8	I. 7	16-17	$1, 200	204	38		
9	7	17	200	197	53	1860	1860

*About.

TABLE II.—*Statistics of instruction in chemistry*

Name of institution.	Post-office address.	No. of teachers. Number in chemistry.	No. of teachers. Number in physics.	No. of teachers. Total number for both branches.	Do these teachers instruct in other subjects?	Grade of the course in which these studies are begun. Chemistry.	Grade of the course in which these studies are begun. Physics.
1	2	3	4	5	6	7	8
SECONDARY SCHOOLS—Cont'd.							
Male and Female Academy	Sharpsburg, Ky	1	1	1	Yes.	Sophomore	Sophomore
Winchester Male and Female High School.	Winchester, Ky	1	1	1	Yes.	Intermediate	Jun. intermed.
Morehouse College	Bastrop, La	1	1	1	Yes.	2d year	2d year
Academy of St. Vincent	Shreveport, La	1	2	....	Yes.	3d class	3d class
East Maine Conference Seminary.	Bucksport, Me	1	1	1	Yes.		
Corinna Union Academy	Corinna, Me	1	2	2	Yes		
Limington Academy	Limington, Me		..	2	Yes.		
Eaton Family and Day School	Norridgewock, Me	1	1	1	Yes.		
Paris Hill Academy	Paris, Me						
Patten Academy and Free High School.	Patten, Me	1	1	1	Yes.		
Maine Central Institute	Pittsfield, Me	1	1	1	Yes.		
Franklin Family School	Topsham, Me	1	1		No.		
Oak Grove Seminary and Commercial College.	Vassalboro', Me	1	1	1	Yes.	Optional	Optional
Waterville Classical Institute	Waterville, Me	1	1	1	Yes.	4th year	2d year
Friends' Elementary and High School.	Baltimore, Md	1	1	1	No.	Class B	Class B
Knapp's Institute	Baltimore, Md	1	1		Yes.		
Mt. Vernon Institute	Baltimore, Md	1	1	2	Yes.		
St. Joseph's Academy (Calvert Hall).	Baltimore, Md	0	1	1	Yes		Academic
School for Boys, George G. Carey.	Baltimore, Md	1	1	1	Yes.	5th or lowest	5th or lowest
Zion School	Baltimore, Md	2	2	2	Yes.	6th year	6th year
Overlea Home School for Young Gentlemen.	Catonsville, Md	0	1	1	Yes.		
Charlotte Hall School	Charlotte Hall, Md	1	1	2	Yes.	2d grade	2d grade
College of St. James Grammar School.	College of St. James, Md.	1	1	1	Yes.	2d class h. s	3d class h. s
Darlington Academy	Darlington, Md	1	1	1	Yes.	Primary	Primary
Notre Dame of Maryland, Collegiate Institute for Young Ladies.	Govanstown, Md	1	2	....	Yes.	Academic	Academic
Lutherville Female Seminary	Lutherville, Md	1	1	2	Yes.	Junior	Sophomore
McDonogh Institute	Owings' Mills, Md	1	1	1	Yes.		
St. George's Hall for Boys	Reisterstown, Md	1	1	1	Yes		
Rockland Boarding School for Girls.	Sandy Spring, Md	2	2	2	Yes.		
Phillips Academy	Andover, Mass	1	1	1	Yes.	Senior	Middle year
Punchard Free School	Andover, Mass	1	2	2	Yes.	3d year	3d year
Powers Institute	Bernardston, Mass.	1	1	1	Yes.		
Houghton School	Bolton, Mass	1	1	1	Yes.		
Advanced classes in Miss Garland's Kindergarten.	Boston, Mass. (52 Chestnut st).						
Chauncy Hall School	Boston, Mass	1	1	....	1 does	1st class	2d class
English, French, and German Family and Day School.	Boston, Mass. (68 Marlboro' st).						
Home and Day School	Boston, Mass. (68 Chester sq).	1	1	....	Yes.	Junior	Junior
Newbury Street School	Boston, Mass. (34 Newbury st).	1	2	2	Yes.	Preparatory	Preparatory
Hitchcock Free High School	Brimfield, Mass	1	1	....	Yes.	3d year	3d year
High School	Concord, Mass	1	1	1	Yes.	3d year	2d year
Deerfield Academy and Dickinson High School.	Deerfield, Mass	1	1	1	Yes.	4th year	2d year
Partridge Academy	Duxbury, Mass	1	1	1	Yes.	Middle year	Middle year
Lawrence Academy	Falmouth, Mass	1	1	1	Yes.		

*Probably. †About.

and physics in secondary schools, &c.—Continued.

Course of study.		Average age of pupils beginning these studies.	Approximate value of chemical and physical apparatus.	Text books used.		Instruction began.	
Chemistry.	Physics.			In chemistry.	In physics.	Chemistry.	Physics.
9	10	11	12	13	14	15	16
11	9	15	....	178	53	*1847	*1847
9	7	10–16	$100	204	29, 33	*1872	*1872
9	7	15	50	190, 204	35, 45	1864	1864
11	9	11	Nothing	204	37	....	......
9	7	17–18	$1, 000	190	33	1850	1850
I. 9	I. 7	18	50	204	39	1851	1851
11	9	17	....	190	45	1850	1850
8	7	16	600	190	45	1856	1856
None	None	....	....	....	....	....	......
11	7	13	90	190	53	1846	1846
9	7	18–19	Small	204	33	....	......
....	....	16	....	190	45	....	......
9 or 11	7 or 9	16	....	....	....	....	......
L. 9	L. 7	16–18	$500	182	41	†1820	†1820
7	7	13	3, 000	175	32	†1866	†1866
10	8	13–14½	500	Instruction oral	Instruction oral	1869	1869
9	7	14–16	300	182, 190	41	....	......
None	9	13	....	....	39	....	......
11	9	12	....	137	7	1878	1869
9	7	13–14	....	Instruction oral	Instruction oral	†1859	†1859
None	9	10	....	....	39, 326	....	......
8	7	15–17	1, 500	135, 183	6	‡1851	‡1851
8	7	15–16	500	102, 183, 190, 219	13 or 38? 41	1842	1842
11	9	16	....	175, 190	32, 39, 45	....	......
9	7	16	....	204	37, 45	1858	1858
8	7	16	Costly, but old.	204	53	1853	1853
9	7	15	$100	141	38, 47, 63	1874	1873
9	7	13–14					
....	....	14	300	178, 324	324	....	......
I. 7, t	I. 7	17–18	5, 000	140, 233	13	†1830	†1830
I. 8, t	I. 6	15	2, 000	141	41	1856	1856
9	7	16	300	141	39	....	......
11	9	19	....	184	39	....	......
I. 10	I. 8	8	....	....	....	....	......
8	7	15–16	600	141	1, 38	1828	1828
....	....	....	....	....	....	1866	1866
I. 9	I. 7	16	....	....	2, 47	....	......
8	7	12	....	183	2, 45	....	......
8	7	17	500	141	7	1871	†1856
I. 9	I. 7	15–16	200	204	33	....	......
K. 8, t	K. 6	15	1, 200	120	324	....	......
I. 9	I. 7	15	300	190	46	1877	1845
11	9	15	Little	190	45	1869	1869

‡ Before.

TABLE II.—*Statistics of instruction in chemistry*

Name of institution.	Post-office address.	No. of teachers. Number in chemistry.	Number in physics.	Total number for both branches.	Do these teachers instruct in other subjects?	Grade of the course in which these studies are begun. Chemistry.	Physics.
1	2	3	4	5	6	7	8
SECONDARY SCHOOLS—Cont'd.							
Sedgwick Institute	Great Barrington, Mass.	1	1	1	Yes.		
Prospect Hill School	Greenfield, Mass	1	1	1	Yes.		
Lawrence Academy	Groton, Mass	1	1	1	Yes.	2d year	2d year
Hanover Academy	Hanover, Mass	0	1	1	Yes.		High
Eaton Family School	Middleboro', Mass	1	1	1	Yes.		
Coffin School (Lancasterian School).	Nantucket, Mass	1	1	1	Yes.	Senior	Senior
Adams Academy	Quincy, Mass	0	1	1	Yes.		Next to highest
Sawin Academy and Dowse High School.	Sherborn, Mass	1	1	1	Yes.	2d year	2d year
Dummer Academy	South Byfield, Mass	1	1	2	Yes.	2d year	1st year
Edwards Place School	Stockbridge, Mass	..	..	....	......		
West Newton English and Classical School.	West Newton, Mass	1	1	....	Yes.		
Wesleyan Academy	Wilbraham, Mass	1	1	1	Yes.	Senior	2d year
Highland Military Academy	Worcester, Mass	1	1	1	Yes.		
Worcester Academy	Worcester, Mass	1	1	1	Yes.		
St. Mary's Academy	Monroe, Mich	2	1	2	......	5th senior	4th senior
St. Croix Valley Academy	Afton, Minn	1	1	....	Yes.		
Caledonia Academy	Caledonia, Minn	..	1	....	......		3d year
Wesleyan Methodist Seminary	Wasioja, Minn	1	1	1	Yes.	4th year	1st year
Yazoo District High School	Black Hawk, Miss	1	1	2	Yes.	2d collegiate	2d collegiate
Blue Mountain Female College	Blue Mountain, Miss	1	1	2	Yes.	Collegiate	Collegiate
Grange High School	Fayette, Miss	1	1	1	Yes.	Junior	Junior
Pontotoc Male Academy	Pontotoc, Miss	1	1	2	Yes.	Freshman	Freshman
The Kemper Family School	Boonville, Mo	1	1	1	Yes.	1st year	1st year
Van Rensselaer Academy	Rensselaer, Mo	1	1	1	Yes.		
High School in St. Charles College.	St. Charles, Mo	1	1	1	Yes.	Junior	Sophomore
Young Ladies' Institute	St. Joseph, Mo	1	1	....	Yes.	3d collegiate	3d collegiate
Stewartsville Male and Female Seminary.	Stewartsville, Mo	1	1	1	Yes.	Collegiate	Collegiate
Austin Academy	Centre Stafford, N. H	..	1	....	Yes.		Grammar sch
Pinkerton Academy	Derry, N. H	1	1	1	Yes.		
Franklin Academy	Dover, N. H	1	1	2	Yes.		
Phillips Exeter Academy	Exeter, N. H	1	1	1	Yes.		
Penacook Normal Academy	Fisherville, N. H	1	1	1	Yes.	Optional	Optional
Francestown Academy	Francestown, N. H	1	1	1	Yes.		
Gilmanton Academy	Gilmanton, N. H	1	1	1	Yes.	Scientific	Scientific
Hampton Academy	Hampton, N. H	1	1	1	Yes.		
Hillsborough Bridge Union School and Valley Academy.	Hillsborough Bridge, N. H.	1	1	1	Yes	Senior	Senior
Contoocook Academy	Hopkinton, N. H. (Contoocookville).	0	1	1	Yes.		
Kingston Academy	Kingston, N. H	0	1	1	Yes.		Middle grade
Lancaster Academy	Lancaster, N. H	1	1	1	Yes.		
Kimball Union Academy	Meriden, N. H	1	1	1	Yes.	Middle	Junior
McCollom Institute	Mt. Vernon, N. H	1	1	2	Yes.	3d year	2d year
Nashua Literary Institution	Nashua, N. H	0	1	1	Yes.		Optional
New Hampton Literary Institution.	New Hampt'n, N. H.	1	1	....	Yes.	Third	Second
Appleton Academy	New Ipswich, N. H.	1	1	1	Yes.		
Colby Academy	New London, N. H.	1	1	2	Yes	Senior	2d year
North Conway Academy	N'th Conway, N. H.	1	1	1	Yes		
Pembroke Academy	Pembroke, N. H	1	1	2	Yes.		
Smith's Academy and Commercial College.	Portsmouth, N. H	1	1	2	Yes.		
McGaw Normal Institute	Reed's Ferry, N. H.	1	1	1	Yes.		
Simonds Free High School	Warner, N. H	1	1	1	Yes.		
Kearsarge School of Practice	Wilmot, N. H	1	..	....	......	2d year	2d year
Blair Presbyterial Academy	Blairstown, N. J	1	1	2	Yes.		

* About. † Early as.

and physics in secondary schools, &c.—**Continued.**

Course of study.		Average age of pupils beginning these studies.	Approximate value of chemical and physical apparatus.	Text books used.		Instruction began.	
Chemistry.	Physics.			In chemistry.	In physics.	Chemistry.	Physics.
9	10	11	12	13	14	15	16
....	....	14	....	....	2	....	....
7	7	15	....	140	32, 39	....	....
L. 9	L. 7	15	$1, 000	204	2	1869	*1859
None	7	15	200	....	45	....	....
9	....	14	60	190	....	1878	1875
9	7	16	700	190	45	....	....
None	9	16½	Nothing	....	1, 41	....	1877–8
8	7	14	$100	141, 204	47	1874	1874
11	9	15–16	Slight	190	45	....	....
....	....	....	....	....	53	....	....
9	7	15–16	$250	184, 204	39, 48	1848	1848
M. 9	K. 7	16½	3, 000	137	33	1825	1825
9	7	16	2, 000	141	33	1857	1857
7	7	17	1, 000	124	....	....	....
8	7	17	600	324	39	1864	1864
....	....	....	300	....	....	1869	1869
....	K. 9	15	....	....	39	....	1876
K. 9	K. 9	19	25	204	32	....	....
I. 9	7	16	100	190	39, 45	....	†1869
9	7	16	....	190	39	1874	1874
11	9	16	25	190	33	1878	1878
11	9	16	Nothing	190	45	....	....
I. 9	I. 7	14	$400	157, 184	2, 48	....	....
L. 9	L. 9	18	Nothing	190	45	1840	1840
9	7	16	$100	175	32	‡1861	‡1861
9	7	15	300–400	157	45	....	....
9	7	20	300	190	35, 45	*1865	*1865
None	9	15	Nothing	....	39	....	§1830
7	O. 7	17	$500	124, 127, 128, 140, 238	32	....	....
....	....	14–20	....	190	2	....	....
....	6	17	700	184	1	....	....
9	9	15	15	190	39	1876	....
8	7	16	400	190	45	‖1874	‖1874
M. 9	K. 7	16	100	324	32	....	....
....	....	16	....	....	....	....	....
....	....	15–18	....	204	39	....	....
None	9	....	Nothing	....	39	....	....
None	....	15	$150	....	2	....	....
M. 9	M. 7	16	200	190	45	....	....
O. 8	O. 7	15–18	3, 000	141	38	....	....
M. 9	M. 7	17–18	300	190	45, 48	....	....
None	7	16	100	....	53	....	1835
N. 9	L. 7	15–20	1, 500	141	33	....	....
8	7	16	600	190	39	....	....
9	7	18	1, 000	168	45	§1853	§1853
11	9	15	Nothing	204	39	....	....
9	9	17	....	141	33	....	....
9	7	13	....	190	39	1873	1873
9	7	16	$100	190	46	1875	1875
11	9	16	Nothing	190	45	....	....
9	7	20	$200	141	38	....	....
11	9	16–17	....	140	38	....	....

‡ Before. § Probably. ‖ Especially since.

TABLE II.—*Statistics of instruction in chemistry*

Name of institution.	Post-office address.	No. of teachers.			Do these teachers instruct in other subjects.	Grade of the course in which these studies are begun.	
		Number in chemistry.	Number in physics.	Total number for both branches.		Chemistry.	Physics.
1	2	3	4	5	6	7	8
SECONDARY SCHOOLS—Cont'd.							
South Jersey Institute	Bridgeton, N. J	1	1	1	Yes.	3d year	3d year
The Misses Hayward's School	Elizabeth, N. J	..	..	....	......	Senior	Senior
English and Classical School	Flemington, N. J	0	1	1	Yes.	...	...
Freehold Institute	Freehold, N. J	1	1	...	Yes.	2d year, h. s	2d year, h. s
Hackensack Academy	Hackensack, N. J	1	1	1	Yes.	Last year (?)	Last year (?)
Centenary Collegiate Institute	Hackettstown, N. J.	1	1	....	Yes.	Senior	Middle
Peddie Institute	Hightstown, N. J	1	1	2	Yes	...	...
Martha Institute	Hoboken, N. J	1	1	1	Yes	3d year	3d year
Stevens High School	Hoboken, N. J	1	1	1	No	...	...
Hasbrouck Institute	Jersey City, N. J	1	1	2	Yes	...	...
Lawrenceville Female Seminary	Lawrenceville, N. J.	..	..	1	Yes	...	...
Cedar Grove Boarding School for Young Ladies.	New Brunswick, N. J.	2	2	2	Yes.	...	...
Seminary for Young Ladies	New Brunswick, N. J. (13 Lexington ave.).	2	1	2	......	Collegiate	...
Newton Collegiate Institute	Newton, N. J	1	1	1	Yes.	...	...
Miss Matthews' School	Summit, N. J	1	0	1	Yes.	...	...
Hungerford Collegiate Institute.	Adams, N. Y	1	1	1	Yes.	3d year	3d year
Amenia Seminary	Amenia, N. Y	1	1	....	Yes.	Academic	Academic
Amsterdam Academy	Amsterdam, N. Y	1	1	2	Yes.	Elementary	Elementary
Ives Seminary	Antwerp, N. Y	1	1	2	Yes	...	...
Augusta Academy	Augusta, N. Y	..	..	1	Yes.	...	...
Cayuga Lake Academy	Aurora, N. Y	1	1	1	Yes	Academic	Academic
Union Academy of Belleville	Belleville, N. Y	1	1	1	Yes.	...	...
Adelphi Academy	Brooklyn, N. Y. (Lafayette ave.).	1	1	1	Yes.	2d year	2d year
Chénevière Institute	Brooklyn, N. Y. (19 Elm Place).	1	1	....	Yes.	...	...
German, English, and French Academy.	Brooklyn, N. Y. (247 State st.).	1	1	1	Yes.	...	...
Heathcote School	Buffalo, N. Y	1	1	....	Yes	3d grade	3d grade
Cincinnatus Academy	Cincinnatus, N. Y	1	1	....	Yes.	Ungraded	Ungraded
Clifton Springs Seminary	Clifton Spr'gs, N. Y.	1	1	....	Yes.	Junior	Junior
Clinton Grammar School	Clinton, N. Y	1	1	2	Yes.	3d year	3d year
Dwight's Home School for Girls.	Clinton, N. Y	1	1	1	Yes.	...	...
Houghton Seminary	Clinton, N. Y	1	1	1	Yes.	Junior	Junior
Leseman's Academy	College Point, N. Y.	1	1	1	Yes.	1st class	1st class
Dansville Seminary	Dansville, N. Y	1	1	1	Yes.	...	...
Deansville Academy	Deansville, N. Y	0	2	2	Yes	...	...
Delaware Academy	Delhi, N. Y	1	1	1	Yes.	...	...
S. S. Seward Institute	Florida, N. Y	0	1	1	Yes	...	...
Flushing Institute	Flushing, N. Y	1	1	1	Yes.	...	...
Fort Edward Collegiate Institute	Fort Edward, N. Y.	1	1	1	Yes.	...	...
Falley Seminary	Fulton, N. Y	1	1	1	Yes.	...	...
Gilbertsville Academy and Collegiate Institute.	Gilbertsville, N. Y.	1	1	1	Yes.	3d academic	2d academic
Glen's Falls Academy	Glen's Falls, N. Y	1	1	1	Yes.	...	...
Gouverneur Wesleyan Seminary	Gouverneur, N. Y	1	1	1	Yes.	...	...
Hamilton Female Seminary	Hamilton, N. Y	1	1	1	Yes.	Junior	Middle
Hartwick Seminary	Hartwick, N. Y	..	..	1	......	...	...
Cook Academy	Havana, N. Y	1	1	1	Yes.	Middle year	Middle year
Hempstead Institute	Hempstead, N. Y	1	1	1	Yes.	...	...
Hudson Academy	Hudson, N. Y	1	1	1	Yes.	1st year	2d year
The Misses Skinner's School for Young Ladies.	Hudson, N. Y	1	1	2	Yes	4th year	3d year
Le Roy Academic Institute	Le Roy, N. Y	1	1	1	Yes.	Adv. acad	Adv. acad
Genesee Wesleyan Seminary	Lima, N. Y	1	1	1	Yes	Not fixed	Not fixed
Lockport Union School	Lockport, N. Y	1	1	1	Yes.	Academic	Academic
Macedon Academy	Macedon, N. Y	1	1	2	Yes.	...	...
Franklin Academy	Malone, N. Y	1	1	1	Yes.	Senior	2d year

and physics in secondary schools, &c.— Continued.

Course of study.		Average age of pupils beginning these studies.	Approximate value of chemical and physical apparatus.	Text books used.		Instruction began.	
Chemistry.	Physics.			In chemistry.	In physics.	Chemistry.	Physics.
9	10	11	12	13	14	15	16
8	7	16–18	$800	140		1870	1870
		16–18		157	39		
None	9	16	Nothing		37, 38		1876
8	7	13	$3, 000	Liebig and others		1843	1843
L.	L.	16		182	41		
I. 7	K. 7	16–18		120, 141, 223	2	1875	1875
9	7	16–17		140	2	1868	1868
12	10	20					
9	7	15½		182		1871	1871
8	9 or 7	15					
9	7	15–16		190	324		
		16		204	39		
9	7	15–18	150	139	10, 38, 49		
11 or 9	9 or 7	17	Slight	157	45		
		15		137			1878
O. 9	O. 7	17	$1, 200	141	32		
9	7	15	300	157	39		
8	6	16	500	137	7	1869	1869
		16	1, 500	190	45		
			300				
7	7	15	550	190	45		
O. 9	O. 7	17	1, 000	190	46		
I. 7, t	I. 7	17	2, 500	140, 204, 250		1867	
		17					
I. 9 or 11	I. 7 or 9	13		327	327		
9 or 11	7 or 9	14		149	38	1865	1865
11	7	16	478	183	38	1857	1857
		16		190, 197	45, 53		
9	7	16	200	324	45	1815	1815
		15–16					
L. 9	L. 7	18	350	141	32		
9	7	13	250	183	53	1878	1860
O. 9	O. 7	18	150	190	45	1858	1858
None.	9	19	Nothing.		45		*1870
8	7	18	$1, 800	178	53	1830	1830
None.	7	16	160		2		
		16	250	124, 141	38, 41		
O. 8	O. 7	17–19	1, 500	190, 204	7, 39, 45	1854	1854
9	7	17–18	1, 500	190	2		
9	7	16–17	263. 53	190	45	1840	1840
9	7	16	500	204	2		
8	7	17	275	190	45	1830	1830
I. 8	I. 7	16–18		204	53	1866	1866
11	7	18–20	500	197	7, 53	1815	1815
M. 9	M. 7	17–18	500	175	7	1872	1872
8	7	13	100	178	33	1838	1838
L. 9	L. 7	16	900	175	32		
11	L. 9	16		182	41		
8	7	17	500	120, 182	32	1865	1865
K. 9	K. 7	17–18	3, 000	137, 157	2, 7		
O. 9	O. 7	16	800	204	41	†1849	†1849
9	7	15	200	190	45	*1849	*1849
M. 8	K. 7	14–17	500	182	38		

* About. † Early as.

TABLE II.—*Statistics of instruction in chemistry*

Name of institution.	Post-office address.	No. of teachers. Number in chemistry.	Number in physics.	Total number for both branches.	Do these teachers instruct in other subjects?	Grade of the course in which these studies are begun. Chemistry.	Physics.
1	2	3	4	5	6	7	8
SECONDARY SCHOOLS—Cont'd.							
Family School (Rev. R. G. Williams).	Mechanicsville, N. Y	1	1	1	Yes.		
Mechanicsville Academy	Mechanicsville, N. Y	1	1	2	Yes.		
Medina Free Academy	Medina, N. Y	1	1	1	Yes.	Highest	Highest
Mexico Academy	Mexico, N. Y	1	1	1	Yes.		
Monticello Academy	Monticello, N. Y	1	1	1	Yes.	2d year	1st year
Naples Academy and Union School.	Naples, N. Y	1	1	1	Yes.	Academic	Academic
New Berlin Academy	New Berlin, N. Y	1	1	1	Yes.	3d year	3d year
Newburgh Institute and Family School for Boys.	Newburgh, N. Y					Preparatory	Preparatory
New Paltz Academy	New Paltz, N. Y	1	1	1	Yes.	Junior	Junior
Academy of the Holy Cross	New York, N. Y	1	3	3	Yes.	Highest	Fifth
Charlier Institute	New York, N. Y			2			
Duane S. Everson's School for Boys.	New York, N. Y. (729 6th avenue).	1	1	1	Yes.	Highest	Highest
Fort Washington College	New York, N. Y	2	2		Yes.	Preparatory	Preparatory
Friends' Seminary	New York, N. Y. (cor. Rutherford Place and E. 16th st.)	1	1	2	Yes.	10th grade	10th grade
Private School of John MacMullen and E. Fezandié.	New York, N. Y. (1214 Broadway).	1	1	1	Yes.	Primary	Primary
University Grammar School	New York, N. Y. (1481 Broadway).		1				
North Chili Seminary	North Chili, N. Y	1	1	1	Yes.	2d year	2d year
Rockland College	Nyack, N. Y	1	1	1	Yes.	Middle	Junior
Onondaga Academy	Onondaga Valley, N. Y.	1	1	1	Yes.	2d year	1st year
Peekskill Academy	Peekskill, N. Y	1	1	1	Yes.	1st year acad	1st year acad
Pike Seminary	Pike, N. Y	1	1	1	Yes.		
Pompey Academy	Pompey, N. Y	1	1	2	Yes.	Academic	Academic
Port Chester Commercial College and Military Institute.	Port Chester, N. Y	1	1	1	Yes.		
Brooke Seminary for Young Ladies.	Poughkeepsie, N. Y.	1	1	1	Yes.		
Poughkeepsie Military Institute	Poughkeepsie, N. Y.	1	1	1	Yes.		
Franklin Academy	Prattsburgh, N. Y	1	1	1	Yes.	Academic	Academic
Red Creek Union Seminary	Red Creek, N. Y	1	1	1	Yes.	Academic	Academic
De Garmo Institute	Rhinebeck, N. Y	1	2	3	Yes.		
Female Academy of the Sacred Heart.	Rochester, N. Y	1	3	4	Yes.	Academic	Grammar
Rochester Female Academy	Rochester, N. Y	1	1		Yes.		
Park Institute	Rye, N. Y	1	1	1	Yes.	Grammar	Grammar
Temple Grove Seminary	Saratoga Springs, N. Y.	1	1	2	Yes.	Sen. middle	Sen. middle
Saugerties Institute	Saugerties, N. Y	0	1	1	Yes.		
Rogersville Union Seminary	South Dansville, N. Y.	1	1	1	Yes		
Troy Academy	Troy, N. Y	1	1	1	Yes.		
Trumansburg Academy	Trumansburg, N. Y.	1	1		Yes.	Academic	Academic
Walton Academy and Union School.	Walton, N. Y	1	1	1	Yes.	2d year acad	2d year acad
Riverside Seminary	Wellsville, N. Y	1	1	2	Yes.	Academic	
West Winfield Academy	West Winfield, N. Y.	1	1	1	Yes.		
Alexander Institute	White Plains, N. Y.	1	1	1	Yes.		
Whitestown Seminary	Whitestown, N. Y	1	1	2	Yes.		
The Rev. Montgomery R. Hooper's Academy.	Yonkers, N. Y	1	1	1	Yes.		
Belvidere Academy	Belvidere, N. C	1	1	1	Yes.		
Charlotte Institute for Young Ladies.	Charlotte, N. C	1	1	1	Yes.	Preparatory	Preparatory

***and physics in secondary schools, &c.*—Continued.**

Course of study.		Average age of pupils beginning these studies.	Approximate value of chemical and physical apparatus.	Text books used.		Instruction began.	
Chemistry.	Physics.			In chemistry.	In physics.	Chemistry.	Physics.
9	10	11	12	13	14	15	16
I. 11	I. 9	16–18	Slight.	204	39		
8	7	16–18	$300–400	182	45	1868	1868
8	7	16	100	190	38, 45		
7	7	17	500	141, 235	45		
9	7	14	180	190	45	*1848	*1848
8	7	16	600	190	53	1861	1861
9	7	16		197	53	1844	1844
10	8						
9	7	14	600	204	53	*1849	*1849
E.		11-15	30	190	7, 37, 38	1872	1858
9	7	17		182	41	†1859	†1859
		14		184, 190	45, 48		
8	7		2, 500	170, 190		1859	1859
9	7	15	350	137	39		
7 t.	7	9–14	100	120, 230		1859	1859
None.							
M.	M.	17	25	190	53	1869	1869
8	7	17		139	10		
9	7	16	400	190	45	1813	1813
9	7	12	200	137	7		
9	7	18	850	190	45	1863	1863
9 or 11	7 or 9	17	25	190	45		
		14		135	39	1854	1854
9	7	17	200	190	45	1871	1871
L. 9	L. 7	15	150	190	45		
M. 11	M. 9	17	25	190	53		
9	7	18	300	190	38	1840	1840
9	7		1, 500	128, 137, 204	7, 41		
9	7	13	100	182	37, 39, 49		
9	7	16–17	200	182, 190	45	1837	1837
9	7	14	1, 000	184	48		
O. 9	O. 7	17	500	204		1868	1868
None	7	15	135		45, 109		1878
M. 9	M. 7	20	250	190	39, 45		
9	7	16	300	190	45, 325	†1859	†1859
0	7	17	150	190	45		
9	7	16		190	53		
9	7	16	200	190	37		
7	O. 7	17	1, 200	140, 190, 235, 238	13, 14, or 38? 53		
9	7	15	500–600	124	28		
K. 9	I. 7	18	2, 000	190	41		
9	11			183	51, part I		
11	9		Nothing	140, 190	39, 45		
		12–15		184, 204	2, 48	1857	1857

*About. †Before.

TABLE II.—*Statistics of instruction in chemistry*

Name of institution.	Post-office address.	No. of teachers. Number in chemistry.	Number in physics.	Total number for both branches.	Do these teachers instruct in other subjects?	Grade of the course in which these studies are begun. Chemistry.	Physics.
1	2	3	4	5	6	7	8
SECONDARY SCHOOLS—Cont'd.							
Scotia Seminary	Concord, N. C	1	1	2	Yes.	2d yr. higher	2d yr. higher
Rock Spring Seminary	Denver, N. C	0	1	1			
Graham High School	Graham, N. C	1	1	...	Yes.		
New Garden Boarding School	New Garden, N. C	...	1	...			
Catawba High School	Newton, N. C	1	1	2	Yes.		
Locust Hill Seminary	Pittsborough, N. C	0	1	1	Yes.		4th from highest.
Reynoldson Male Institute	Reynoldson, N. C		..	...			
Rev. Daniel Morrelle's English and Classical School.	Wilmington, N. C		..	...			
Alum Creek Academy	Ashley, Ohio		1	1	Yes.	2d academic	2d academic
Grand River Institute	Austinburg, Ohio		1	...	Yes.		
Bartlett Academy	Bartlett, Ohio		1	1	Yes.		
Chickering Institute	Cincinnati, Ohio		1	1	Yes.	3d year	4th year
Mount St. Vincent's Academy, Cedar Grove.	Cincinnati, Ohio		1	1	Yes.	Grad. class	Grad. class
Clermont Academy	Clermontville, Ohio	1	1	1	Yes.	3d year	3d year
Brooks School	Cleveland, Ohio	2	2	2	No.	3d class	3d class
Cleveland Academy	Cleveland, Ohio			2	Yes.	Academic	Academic
Harcourt Place Academy	Gambier, Ohio	1		1	Yes.		
Hartford Academic Institute	Hartford, Ohio	1		1	Yes.	Academic	Academic
Lexington Seminary	Lexington, Ohio	2		2	Yes.	H. S. or coll. prep.	H. S. or coll. prep.
Medina High School	Medina, Ohio	1		1	Yes.	2d year	2d year
New Hagerstown Academy	New Hagerstown, Ohio.	..		1	Yes.		
Pierpont Central High School	Pierpont, Ohio	1		1	Yes.		
Fairfield Union Academy	Pleasantville, Ohio	1		1	Yes.		
Academy of the Ursulines	St. Martin's, Ohio			3	Yes.	2d prep. grade.	2d prep. grade.
Savannah Male and Female Academy.	Savannah, Ohio		1	2	Yes.	Last year	Last year
Springfield Seminary	Springfield, Ohio		1	1	Yes.		
Jefferson Institute	Jefferson, Oreg		1	1	Yes.		
St. Michael's College	Portland, Oreg	.		...			
Umpqua Academy	Wilbur, Oreg		1	1	Yes.	3d or last	3d or last
School for Girls (Miss Maitland)	Allegheny, Pa	1	1	...	Yes.		
Beaver College and Musical Institute.	Beaver, Pa	1	1	1	Yes.	Third	First
Mt. Pleasant Seminary	Boyertown, Pa		1	...	Yes.		
Witherspoon Institute	Butler, Pa	1	1	1	Yes.	Last year	Last year
Chester Academy	Chester, Pa	1	1	1	Yes.		
Maplewood Institute	Concordville, Pa	1	1	2	Yes.		
Doylestown Seminary	Doylestown, Pa	1	1	1	Yes.	Middle class	Middle class
Trach's Academy	Easton, Pa	0	1	1	Yes.		Sen. normal
Eldersridge Academy	Eldersridge, Pa	..	..	1	......	Sophomore	Sophomore
Germantown Academy	Germantown, Pa	1	1	1	......	Acad. dept	Acad. dept
Hollidaysburg Seminary	Hollidaysburg, Pa	1	1	1	No.	Third	Third
Wyoming Seminary	Kingston, Pa	1	1	1	Yes.	2d year	2d year
English Academy of the University at Lewisburg.	Lewisburg, Pa	..	..	...			Last prep
Linden Hall Seminary	Lititz, Pa	..	1	...	Yes.		
Western Pennsylvania Classical and Scientific Institute.	Mt. Pleasant, Pa	1	1	1	Yes.	Middle year	Middle year
Nazareth Hall	Nazareth, Pa	1	1	2	Yes.	Highest	Highest
Treemount Seminary	Norristown, Pa	1	2	2	Yes.		
Academy of the Protestant Episcopal Church.	Philadelphia, Pa. (Locust and Juniper streets).	1	1	1	No.		
Broad Street Academy	Philadelphia, Pa. (337 S. Broad st.).	1	4	4	Yes.		

* Probably.

and physics in secondary schools, &c.—Continued.

Course of study.		Average age of pupils beginning these studies.	Approximate value of chemical and physical apparatus.	Text books used.		Instruction began.	
Chemistry.	Physics.			In chemistry.	In physics.	Chemistry.	Physics.
9	10	11	12	13	14	15	16
11	9	20	Nothing	190	45	...	...
None	10	16	Nothing	...	31, 53	1873	1873
11	9	16–18	Nothing	190	45	*1837	*1837
Irregular	9	15	...	183	53	†1849	†1849
9	7	17	$150	190	53	†1852	†1852
None	7	12	300	...	45	1861	1861
...	...	...	...	197	39	...	...
Rarely taught.	Rarely taught.	...	Phys., 150	...	...	...	...
11	9	15	10	204	38	†1854	†1854
9	7	18	200	127 or 128? 190	38	...	...
11	O. 9	19	...	...	32	‡1867	‡1867
I. 8, t	I. 7	15–18	2,000	175	47	1857	1857
9	7	17	300	190	14	1877	1862
9	7	18	100	124, 140, 204	...	†1840	†1840
E. 6, t	7	16	3,000	124, 162, 183, 238, 262	9, 14	1874	1874
...	...	16	200	140	13, 14, or 38?	...	...
9	9	...	...	184	53	...	...
K. 8	K. 7	15	...	190	2	1871	1871
9	7	16	Phys., 40	204	39	1854	1854
O. 9	O. 7	16	40–50	137	39	§1874	§1874
...	6	16	...	...	43	...	...
K.	K.	16	...	190	39	1864	1864
7	6	20	...	182	41	1870	1870
E. 9	A. 7	15–17	1,200	204	33	1850	1845
9	7	18	...	183	39	...	...
8	7	18	...	204	41	...	...
9	7	17	...	157	37, 38	1869	1850
None	None	...	...	...	...	...	...
L. 8	L. 7	16	100	190	45	1850	1850
...	...	15	...	182	7, 53, 326	...	...
9	7	16	300	204	32, 38, 45	1859	1856
9	7	14	25	190	37, 45	1842	1842
9	7	17	150	204	38	1849	1849
7	7	15	300	141, 197, 238	13, 14, or 38? 45, 53	...	...
7, 13	7	14–20	500	190, 238, 256, 266	35	1862	1862
7	7	16	500	204	39	1865	1865
...	...	15	...	...	324	...	1872
Rarely taught.	Rarely taught.	...	Slight	Optional	Optional	...	...
10	8	13	$200	...	...	1877	1877
6	7	16	1,000	...	13, 14, or 38? 32	1869	1869
L. 9	L. 7	18	1,000	141	2	...	...
None	K	...	...	...	2	...	...
9	7	...	350	190	41	...	...
9	7	18	100	137	39	1873	1873
9	7	14	1,500	137	28	†1790	†1790
...	...	16	...	...	...	1844	...
10	8	14	2,000	None used	None used	1850	1850
9	7	10	100–200	184	48, 323	1863	1863

† About. ‡ Since. § With apparatus.

TABLE II.—*Statistics of instruction in chemistry*

Name of institution.	Post-office address.	No. of teachers. Number in chemistry.	No. of teachers. Number in physics.	No. of teachers. Total number for both branches.	Do these teachers instruct in other subjects?	Grade of the course in which these studies are begun. Chemistry.	Grade of the course in which these studies are begun. Physics.
1	2	3	4	5	6	7	8
SECONDARY SCHOOLS—Cont'd.							
Fewsmith's Classical and Mathematical School.	Philadelphia, Pa. (1008 Chestnut st.).	1	1	2	Yes.	High school...	Preparatory..
Friends' Select School	Philadelphia, Pa. (Germantown ave.).	1	1	1	Yes.	...	...
Girard College for Orphans	Philadelphia, Pa	1	1	1	No .	4th from highest.	5th from highest.
Miss Anable's School for Young Ladies.	Philadelphia, Pa. (1350 Pine street).	2	2	3	...	...	...
Philadelphia Seminary	Philadelphia, Pa. (719 Brown st.).	1	1	1	Yes.	...	...
St. Sauveur's French and English Academy.	Philadelphia, Pa. (26 and 28 S. 21st street).	2	...	...	Yes.	...	...
Pleasantville High School	Pleasantville, Pa	1	1	1	Yes.	...	...
Reid Institute	Reidsburg, Pa	1	1	1	No	...	...
Clarion Collegiate Institute	Rimersburg, Pa	...	...	...	Yes.	...	...
Cheltenham Academy	Shoemakertown, Pa	1	1	1	Yes.	Next to highest.	Next to highest.
Westtown Boarding School	Street Road, Pa	2	2	2	Yes.	...	...
Hamiltonian Institute	Uniontown, Pa	1	1	1	Yes.	Middle year...	Middle year...
Unionville Academy	Unionville, Pa	0	...	...	Yes.	...	Optional
Williamsport Dickinson Seminary.	Williamsport, Pa	1	1	1	Yes.	Last year	After prep
Collegiate Institute	York, Pa	1	1	1	Yes.	1st scientific ..	1st scientific ..
Prince's Hill Family and Day School.	Barrington Centre, R. I.	1	1	1	Yes.	...	...
Academy of the Sacred Heart	Providence, R. I	1	3	4	Yes.	1st class	6th class
English and Classical School	Providence, R. I. (49 Snow street).	1	1	2	1 does	3d year, h. s ...	2d year, h. s ...
Friends' New England Boarding School.	Providence, R. I	1	1	1	Yes.	Junior	Sophomore
Gowensville Seminary	Gowensville, S. C	0	1	1	Yes.	...	Intermediate..
Lexington High School	Lexington, S. C	1	1	1	Yes.	Junior	Junior
Limestone Springs Female High School.	Limestone Springs, S. C.	1	1		Yes.	Highest	Highest
Reidville Female College	Reidville, S. C	1	1		Yes.	Junior	Junior
Centreville Academy	Centreville, Tenn	1			Yes.	Junior h. s	Junior h. s
Clifton Masonic Academy	Clifton, Tenn	1	1		Yes.	...	...
Lauderdale Male and Female Institute.	Durhamville, Tenn.	1	1		Yes.	...	...
Edgefield Male Academy	Edgefield, Tenn	0	1		Yes.	...	Academic
Friendsville Institute	Friendsville, Tenn	1	1		Yes	5th year	5th year
Huntingdon High School	Huntingdon, Tenn	1			......	Ungraded	Ungraded
Greenwood Seminary	Near Lebanon, Tenn	1	1	1	Yes.	Junior	Junior
Macedonia Academy	Near McKenzie, Tenn.	1	1	2	Yes.	Sophomore	Sophomore
Waters and Walling College	McMinnville, Tenn.	...	...	...	Yes.	Senior	Senior
Morristown Female High School.	Morristown, Tenn	1	1	1	......	2 years before close.	2 years before close.
Mouse Creek High School	Mouse Creek, Tenn.	1	1	1	Yes.	Last year	Last year
Nashville Normal and Theological Institute.	Nashville, Tenn	...	...	...	Yes.	...	...
Oak Hill Institute	Norris Creek, Tenn.	1	1	1	Yes.	Irregular	Irregular
Temperance Hall	Orme's Store, Tenn.	0	1	1	No..	...	Common school
Misses Welch's School	Paris, Tenn	1	1	2	Yes.	Junior	Junior
Peabody High School	Trenton, Tenn	1	1	1	Yes.	4th year	3d year
Dallas Polytechnic Institute	Dallas, Tex	1	1	1	Yes.	High school ...	High school ...
St Mary's Institute	San Antonio, Tex	1	2	2	Yes.	1st grammar...	1st grammar...
Coronal Institute	San Marcos, Tex	1	1	1	Yes.	2d year, h. s ...	2d year, h. s ...
Add Ran College	Thorp's Spring, Tex	1	1	1	Yes.	Sophomore	Sophomore
Barre Academy	Barre, Vt	...	...	...	Yes.	Sub. Junior ...	Sub. Junior ...

* About. † Early as.

and physics in secondary schools, &c.—Continued.

Course of study.		Average age of pupils beginning these studies.	Approximate value of chemical and physical apparatus.	Text books used.		Instruction began.	
Chemistry.	Physics.			In chemistry.	In physics.	Chemistry.	Physics.
9	10	11	12	13	14	15	16
....	....	12–15	$75	197	29, 38, 45, 328	......	......
I. 8	I. 6	12–16	1,300	120, 141	42	1845	1845
E. 9	D. 7	15	5,000–10,000	143, 182	28, 45	1852	1852
L. 8	I.	15	......	......	......	......	......
9	7	15	100	190	45	......	......
....	....	15	......	190	......	1878	......
9	7	15	300	190, 191	32, 45, 117	1867	1867
....	....	15	Slight.	......	......	......	......
11	9	14	$25	204	6, 29	......	......
9	7	15–16	......	190	45	......	......
7	7	15	2,000	141, 241	7, 39	1820	1820
9	7	......	500–600	157, 188	38, 44	1873	1873
None	9	17	Nothing.	......	39	......	*1834
9	7	17–20	......	140	38	†1857	†1857
I. 9	7	15–16	$750	141	32, 33, 44	1854	1854
9	7	16	100	190	45	1870	1870
8	7	‡16–18	......	182, 190	39, 49	1872	1872
7	7	15–16	1,000	140	32	......	......
L. 7	L. 6	15	800–1,000	141	45	§1819	§1819
None	7	16–20	......	......	53	1878	1878
8	7	15	150	190	45	......	......
....	....	17	Cost 2,000	190	45	......	......
9	7	17	1,000	204	53	......	......
11	9	15	Nothing.	190	38	......	......
M. 9	L. 7	......	$30	175	45	......	......
11	9	......	Nothing.	190	45	......	......
None.	7	15	$25	......	6, 39	......	1869
9	7	18	250	190	45	......	......
11	9	17	Nothing.	124	39	......	......
....	....	15	......	175, 190	2	1850	1850
8	7	18	......	178	38	1864	1864
9 or 11	7 or 9	18–20	......	......	......	*1872	*1872
11	9	16	Nothing.	190, 204	39	*1867	*1867
11	9	15	Nothing.	190	39	1859	1859
11	9	......	......	204	53	......	......
9	K. 7	20	$500	175	32, 35	1869	1869
None.	....	18	50	......	......	......	1875
....	....	16	......	204	......	1877	1877
8	7	16–17	150	137, 142, 190	38	‖1856	‖1855
11	9	14–18	Nothing.	190	45	1878	1878
9	7	14–17	$800	137	37, 39	1878	1865
9	7	16	500	175	45	*1869	*1869
8	9	16	Chem. 50	130, 190	......	1871	1871
M. 9	M. 7	17	Cost 1,200	204	2	......	......

‡ Chemistry. § Probably. ‖ By experiment.

TABLE II.—*Statistics of instruction in chemistry*

Name of institution.	Post-office address.	No. of teachers. Number in chemistry.	No. of teachers. Number in physics.	No. of teachers. Total number for both branches.	Do these teachers instruct in other subjects?	Grade of the course in which these studies are begun. Chemistry.	Grade of the course in which these studies are begun. Physics.
1	2	3	4	5	6	7	8
SECONDARY SCHOOLS—Cont'd.							
Goddard Seminary	Barre, Vt	1	1	1	Yes.	2d year	2d year
Bristol Academy	Bristol, Vt	1	1	1	Yes.	H. s. grade	H. s. grade
Vermont Episcopal Institute	Burlington, Vt	1	1	1	Yes.		
Derby Academy	Derby, Vt	1	1	1	Yes.		
Essex Classical Institute	Essex, Vt	1	1	2	Yes	Academic	Academic
Lamoille Central Academy	Hyde Park, Vt	1	1	1	Yes.	First	First
Black River Academy	Ludlow, Vt	1	1	1	Yes.	Higher dept	Higher dept
Lyndon Literary Institute	Lyndon Centre, Vt	1	1	1	Yes.	Jun. scientific.	Jun. scientific.
Beeman Academy	New Haven, Vt	1	1	1	Yes.	Highest	Highest
Caledonia County Grammar School.	Peacham, Vt	1	1	1	Yes.	Academic	Academic
Troy Conference Academy	Poultney, Vt	1	1	1	Yes		
Vermont Academy	Saxton's River, Vt	1	1	2	Yes.	4th year	3d year
Thetford Academy and Boarding School.	Thetford, Vt	1	1	1	Yes.	Adv. English	Adv. English
Glenwood Classical Seminary	W. Brattleboro', Vt.	1	1	1	Yes.		
Alexandria Academy	Alexandria, Va	2	2	2	Yes.	Senior	Senior
Episcopal High School	Near Alexandria, Va	0	1	1	Yes.		
H. F. Henry's School	Alexandria, Va					Junior	Junior
Potomac Academy	Alexandria, Va	1	1		Yes.		
St. John's Academy	Alexandria, Va	1	1		Yes.	6th year	5th year
Kenmore University High School	Amherst C. H., Va	1	1	1	Yes.		
Bethel Military Academy	Bethel Academy P. O., Va.	1	1		Yes		
Piedmont Female Institute	Charlottesville, Va	1	1				
Culpeper Female Institute	Culpeper, Va	1	1		Yes	Intermediate	Intermediate
Herndon Female Institute	Herndon, Va	0	1		Yes		Collegiate
Leesburg Academy	Leesburg, Va	1	1		Yes		
Webster Military Institute	Norfolk, Va	1	1		Yes.		
Norwood High School and College.	Norwood, Va	2	2	2	Yes.	Elective	Elective
Yelverton Home School for Young Ladies and Children.	The Plains, Va		1		Yes		
Fairfax Hall	Winchester, Va	1	1		Yes	6th year	6th year
Wayland University	Beaver Dam, Wis	1	1	1	Yes.	Middle acad	Middle acad
Elroy Seminary	Elroy, Wis	0	1		Yes.		3d year
Lake Geneva Seminary	Geneva, Wis	1	1		Yes.	3d year	3d year
German and English Academy	Milwaukee, Wis	0	1		Yes		
Seminary of St. Francis of Sales	St. Francis Station, Wis.	1	1		Yes.		
Rittenhouse Academy	Washington, D. C	1	1	1			
Roys' Classical and Mathematical Academy.	Washington, D. C. (1315 4½ st., S. W.)			1		All grades	All grades
Waverly Seminary	Washington, D. C	1	1	1	Yes	Senior	Senior
St. Mark's Grammar School	Salt Lake City, Utah.						
Salt Lake Collegiate Institute	Salt Lake City, Utah.				Yes	Academic	Academic
University of Washington Territory.	Seattle, W. T	1	1	2	Yes	Sophomore	Freshman
NORMAL SCHOOLS.							
State Normal School	Florence, Ala						2d grade
Lincoln Normal University	Marion, Ala	1	1	1	Yes.	Second	Second
Branch Normal College, Arkansas Industrial University.	Pine Bluff, Ark	1	1	1	Yes	First	First
California State Normal School	San José, Cal	1	2	2	Yes.	Middle year	Middle year
Connecticut State Normal School	New Britain, Conn	1	1	1	Yes	1st year	1st year
Southern Illinois Normal University.	Carbondale, Ill	1	1	1	Yes	4th year	2d year

and physics in secondary schools, &c.—Continued.

Course of study.		Average age of pupils beginning these studies.	Approximate value of chemical and physical apparatus.	Text books used.		Instruction began.	
Chemistry.	Physics.			In chemistry.	In physics.	Chemistry.	Physics.
9	10	11	12	13	14	15	16
8	7	17	$750	190	45	1870	1870
7	7	17	450	141	2	1855	1855
9	7	16	1,000	190	45	1873	1873
		18			39		
9	7		150	175	45	1854	1854
11	9	18	Nothing.	190	45		
O. 11	O. 9	15–18	Slight.	190	45		
8	7	18	$150	137	7	1871	1871
8	7	18	350	141, 190	35, 45	*1865	*1865
J. 8	L. 7	17	400	178	39		
9	7		350	190	7		
K. 9	K. 7	19–20	150	204	2		
9	7	16	Cost 500	204	39		
K. 8	K. 7	15	300–500	190	45	1876	1876
9	7	14–15	500	178	39		
None.	9	15	Nothing.		39		
				178	53		
9	7			190, 197	23, 53		
9	7	16–17	$1,000	190	45	1849	1849
6	7	17		143, 223, 238, 260	47	1872	1872
8	7	14	500	204	39	1869	1869
				139	45	1867	1867
9	7	14	500	178, 188	38		1876
None.	9	14	Nothing.		45		
11	9	14		143, 184, 204	39, 48	†1845	†1845
9	7	16	Cost $3,000	124, 204	2, 47		
9	7	17		183, 184	47, 48	1865	1865
None.	9	14					
9	7	15	100	190	45	1870	1870
9	7	20	60	190	39		
None.	7	20			2		1876
7	7	18	150	190, 233	45	1869	1869
None.	8	12	2,000		None used		1851
E. 9	E. 7	18	500	197			
9	7	14	100	190	45		
9		14	2	143, 172, 188, 204		1877	1871
11 or 9	9 or 7	16					
9	7	15	500	137	7		
9	7	18	100	190	45	1877	1877
L.	L.	[illegible]	10	190	45	1878	1877
					38, 45		
I. 9	I. 7	16	500	190	45	1873	1873
9	7	15–20		190	7		
L. 8	J. 7	19	3,000	204	41	1872	1864
8	6		500–800	140	2		
I. 7	K. 7	18	1,000	175, 238	32, 33	1874	1874

† Before.

TABLE II.—*Statistics of instruction in chemistry*

Name of institution.	Post-office address.	No. of teachers. Number in chemistry.	No. of teachers. Number in physics.	No. of teachers. Total number for both branches.	Do these teachers instruct in other subjects?	Grade of the course in which these studies are begun. Chemistry.	Grade of the course in which these studies are begun. Physics.
1	2	3	4	5	6	7	8
NORMAL SCHOOLS—Continued.							
Cook County Normal and Training School.	Englewood, Ill	2	2	2	Yes.	3d year	2d year
Illinois State Normal University.	Normal, Ill	..	..	....	......	3d year	3d year
Peoria County Normal School	Peoria, Ill	0	1	1	Yes.		2d year
Indiana State Normal School	Terra Hante, Ind	1	1	1	Yes.		
Iowa State Normal School	Cedar Falls, Iowa	1	1	1	Yes		
Eastern Iowa Normal School	Grandview, Iowa	1	1	1	Yes	Senior elementary.	Senior elementary.
State Normal School	Emporia, Kans	1	1	1	Yes.	Normal	Elementary
Kentucky Normal School	Carlisle, Ky	..	1	1	Yes.		Intermediate
Glasgow Normal School	Glasgow, Ky	1	1	1	Yes.		
Peabody Normal Seminary for Louisiana.	New Orleans, La	1	1	1	Yes.		
Eastern State Normal School	Castine, Me	1	1	2	Yes.		
Western State Normal School	Farmington, Me	..	..	....	......		
Maryland State Normal School	Baltimore, Md	1	1	1	Yes	Last year	Last year
State Normal School	Farmingham, Mass.	1	1	1	Yes.		
State Normal School	Salem, Mass	1	1	1	......	Next below Senior.	Next below Senior.
State Normal School	Westfield, Mass	1	1	2	Yes.		
Massachusetts State Normal School.	Worcester, Mass	1	1	1	Yes.	2d year	2d year
Michigan State Normal School	Ypsilanti, Mich	1	1	....	Yes	11th grade	11th grade
State Normal School at Mankato.	Mankato, Minn	1	1	2	Yes.	High School	High school
State Normal School at St. Cloud.	St. Cloud, Minn	1	1	1	Yes	Academic	Academic
State Normal School at Winona	Winona, Minn	1	1	1	Yes.	2d year	2d year
Mississippi State Normal School.	Holly Springs, Miss	1	1	1	Yes.	3d year	3d year
Tougaloo University and Normal School.	Tougaloo, Miss	1	1	2	Yes.	High school	High school
Southeast Missouri Normal School.	Cape Girardeau, Mo.	1	1	1	Yes.	Elementary	Elementary
North Missouri State Normal School.	Kirksville, Mo	1	1	2	Yes.	2d year	2d year
Normal School	St. Louis, Mo	0	1	1	Yes.	2d year	2d year
State Normal School	Warrensburg, Mo	..	..	....	......		
Nebraska State Normal School	Peru, Nebr	1	1	1	......		
New Hampshire State Normal School.	Plymouth, N. H	1	1	1	Yes.		
New Jersey State Normal and Model School.	Trenton, N. J	1	2	2	Yes	3d year	2d year
State Normal and Training School.	Brockport, N. Y	1	1	1	Yes.		
State Normal School	Buffalo, N. Y	1	1	1	Yes	3d year	3d year
State Normal and Training School.	Cortland, N. Y	1	1	2	Yes	Normal	Normal
State Normal and Training School.	Fredonia, N. Y	1	1	1	Yes.	2d year	2d year
State Normal and Training School.	Geneseo, N. Y	1	1	1	Yes.		
Female Normal College	New York, N. Y	1	4	4	Yes.	2d or Junior	2d or Junior
State Normal and Training School.	Oswego, N. Y	1	1	1	Yes.		
State Normal and Training School.	Potsdam, N. Y	1	1	1	Yes.		
Bennett Seminary	Greensboro', N. C	0	1	1	Yes.		Normal
Shaw University	Raleigh, N. C	..	..	....	......		
Northwestern Ohio Normal School.	Ada, Ohio	1	1	1	Yes.		
Cincinnati Normal School	Cincinnati, Ohio	0	1	1	Yes.		Junior
National Normal School	Lebanon, Ohio	1	2	2	Yes	Preparatory	Preparatory
Western Reserve Normal School	Milan, Ohio	1	1	1	Yes.		
Ohio Central Normal School	Worthington, Ohio	1	1	1	Yes.	Advanced	Advanced

and physics in secondary schools, &c.—Continued.

Course of study.		Average age of pupils beginning these studies.	Approximate value of chemical and physical apparatus.	Text books used.		Instruction began.	
Chemistry.	Physics.			In chemistry.	In physics.	Chemistry.	Physics.
9	10	11	12	13	14	15	16
K. 7	7	18–19	$1,000	140	39	1875	1867
M. 7	M.	......	......	......	......	......	......
None	M. 7	17	170	......	45	......	1868
8	7	18	300	140, 204	7	*1873	*1873
8	6	16	600	120, 157, 204	2, 32	1877	1877
8	I. 7	......	300	204	7, 9, 35	†1867	†1867
8	6	16	......	175, 190, or 204	32 or 45	......	......
......	6	16	100	......	7, 32, 45	......	1875
8	7	19	500	190, 197, 204	33	‡1874	‡1874
11	9	17	......	177	2	......	1879
8	7	20	200	141	33	1867	1867
L.	L.	......	......	......	......	......	......
8 t.	6	18	3,000	None	13	1866	......
L. 8 t.	L. 6	17	1,000	Instruction oral	Instruction oral	......	......
8 t.	6	20	2,000	None	None	1854	1854
L. 8	L.	......	......	......	......	......	......
L. 7 t.	L. 7	20–21	850	136, 140, 230	9	1874	1874
8 t.	7	20	......	......	......	......	......
8	7	18	300	120	41	1868	1868
O. 7	O. 7	......	200	175, 235	......	......	......
I. 8	6	18	......	140	......	......	......
11	9	17	None	190	45	......	......
9	7	18	600	190	45	......	......
9	7	14–17	800	124, 137, 175, 204	7, 32	1874	1874
I. 9	I. 7	16	600	175, 190, 204	33, 63	1872	1872
None	6	17	......	......	......	......	......
J.	J.	......	......	137, 204	7	......	......
K.	M.	......	......	......	......	......	......
9	6	19	875	175	33	......	......
9	7	18	1,000	124	41	1855	1855
L.	L.	......	......	......	......	......	......
L. 9	L. 7	17	2,500	183	32	1871	1871
L. 7 t.	L. 6	17–20	3,000–4,000	183, 235, 238	32, 38, 41	......	......
L. 8	L. 6	18	4,000	140	41	1868	1868
L.	L.	......	......	......	......	......	......
9	7	16	5,000	......	......	......	......
8	6	......	......	......	......	......	......
L.	L.	......	......	......	......	......	......
......	7	18	......	......	45	......	......
11	9	......	......	......	......	......	......
......	M.	......	......	......	45	......	......
None.	9	19	......	......	32	......	1879
N. 8	N. 6	18	1,200	Reference books	Reference books	1855	1855
9	7	18	100?	190	45	......	......
8	7	80	350	140 or 141?	47	1871	1871

* High schools. † Academy. ‡ Experimental.

TABLE II.—*Statistics of instruction in chemistry*

Name of institution.	Post-office address.	No. of teachers: Number in chemistry.	Number in physics.	Total number for both branches.	Do these teachers instruct in other subjects?	Grade of the course in which these studies are begun: Chemistry.	Physics.
1	2	3	4	5	6	7	8
NORMAL SCHOOLS—Continued.							
Pennsylvania State Normal School, 6th district.	Bloomsburg, Pa	1	1	1	Yes	1st scientific	1st elementary
Southwestern State Normal School.	California, Pa	1	1	1	Yes	Normal	Normal
State Normal School	Edinboro', Pa	0					
State Normal School	Indiana, Pa	1	1	1	Yes	Jun. normal	Jun. normal
Keystone State Normal School	Kutztown, Pa	1	1	2	Yes.	Scientific	Scientific
Central State Normal School	Lock Haven, Pa	1	1	1	Yes.	Senior	Senior
Pennsylvania State Normal School.	Mansfield, Pa	1	1	1	Yes		
Pennsylvania State Normal School.	Millersville, Pa	1	1	1			
Philadelphia Normal School for Girls.	Philadelphia, Pa	1	1	1	No	3d grade	3d grade
Cumberland Valley State Normal School.	Shippensburg, Pa	1	1	...	Yes	Scientific	Elementary
West Chester State Normal School.	West Chester, Pa	1	1	1	Yes.	Senior	Junior
Rhode Island State Normal School.	Providence, R. I	1	1	1	Yes	1st half-year	Last half-year
Avery Normal Institute	Charleston, S. C	0	1	1	Yes		Sen. normal
New Providence Institute (Maryville College).	Maryville, Tenn	1	1	1	Yes.	Junior	Junior
Freedmen's Normal Institute	Maryville, Tenn	0	1	1	Yes		Academic
State Normal School	Johnson, Vt						
State Normal School	Randolph, Vt	1	1	1	Yes.	2d course	2d course
Fairmont State Normal School	Fairmont, W. Va	1	1	1	Yes.		
State Normal School at Glenville	Glenville, W. Va	0	1	1	Yes.		
Storer Normal School	Harper's Ferry, W. Va.	1	1	1	Yes.	Normal	Normal
Marshall College State Normal School.	Huntington, W. Va.	0	1	1	Yes		Middle year
Shepherd College	Shepherdstown, W. Va.	1	1	....	Yes.	Senior	Senior
West Liberty State Normal School.	West Liberty, W. Va.	1	1	1	Yes	Academic	Senior
Oshkosh State Normal School	Oshkosh, Wis	1	1	1	Yes	Normal	Normal
Wisconsin State Normal School	Platteville, Wis	1	1	1	Yes.	4th year	2d year
River Falls State Normal School	River Falls, Wis	1	1	1	Yes.		
State Normal School	Whitewater, Wis	1	1	1	Yes.	Junior	Junior
Miner Normal School	Washington, D. C	1	1	1	Yes	1st year	1st year
INSTITUTIONS FOR THE SUPERIOR INSTRUCTION OF WOMEN.							
Florence Synodical Female College.	Florence, Ala	1	1	1	Yes	Sophomore	Sophomore
Judson Female Institute	Marion, Ala	1	1	1	Yes.	Sub-senior	Sub-senior
Marion Female Seminary	Marion, Ala	1	1	1	Yes	Junior	Junior
Alabama Central Female College	Tuscaloosa, Ala	1	1	1	Yes		
Alabama Conference Female College.	Tuskegee, Ala	1	1	1	Yes.		
Hartford Female Seminary	Hartford, Conn	1	1	1	Yes.		
Wesleyan Female College	Wilmington, Del	1	1	2	Yes.	Senior	Junior
Dalton Female College	Dalton, Ga	1	1	1	Yes.		
Lumpkin Masonic Female College.	Lumpkin, Ga	1	1	1	Yes		
Wesleyan Female College	Macon, Ga	1	1	1	Yes.	Sophomore	Sophomore
Marietta Female College	Marietta, Ga	1	1	1	No	Junior	Junior
College Temple	Newnan, Ga	1	1	1	Yes.	Junior	Junior
Illinois Female College	Jacksonville, Ill	1	1	1	Yes.	Junior	Sophomore
St. Mary's School	Knoxville, Ill	1	1	1	Yes.	Middle	Middle

and physics in secondary schools, &c.—Continued.

Course of study.		Average age of pupils beginning these studies.	Approximate value of chemical and physical apparatus.	Text books used.		Instruction began.	
Chemistry.	Physics.			In chemistry.	In physics.	Chemistry.	Physics.
9	10	11	12	13	14	15	16
8	7	17	$200	140 or 141?	35, 45	1869	1867
9	7	18	200		45		
None.	M.				32		
9	7	17	5,000	190	45		
9	7	15	2,500	190	35, 53	1866	1866
9	7	18	300	140 or 141?	2	1878	1877
M.	I.				35		
7				133, 140, 204	35, 45, 59, 63		
9	7	16	3,000	Instruction oral	41		
7	7	17			35, 45	1873	1873
7	7	16–17	500	124, 140, 233	7, 32	1871	1871
E. 8	L. 7	18		141			
None.	7	16	125		45		1867
11	9	16	None.	190		*1850	
None.	7	20	3		45		1876
					45		
N. 9	7	21	500	204	45	1866	1866
L.	L.				32, 324		
None.	7	20	600–800		33, 45		1873
11	9	20		325	325		
None.	7	18	100		32		
9	7	18		157, 175	32	1873	1873
				204	324		
L. 6	6	19–21	2,000	141	33	1871	1871
M. 9	J. 7	19	1,500	204	32, 33	1866	1866
M. 8	I. 7	18	700	204	32, 33	1878	1878
L. 9	L. 7	20	400	140, 204	7, 32	*1869	*1869
11	9	17		184	47 with 17	1877	1877
9	7	17	1,500	190	45	†1839	†1839
7	7	16	2,000	190	2		
L. 9	L. 7	15	350	141	45	1836	1836
9	7	14	About 250	190	45		
9	7	16–18	1,200	204	28, 39	1856	1856
9	7	18	300	204	45	*1829	*1829
8	7	18	1,000	204	45	1837	1837
9	7	15	800	141	2, 38		
11	9	16		204	39	1854	1854
9	7	15	700	204	28	1839	1839
8	7	14	100	204	38	1877	1877
9	7	15	3,000			1849	1849
9	7	18	1,000	190	41	1847	1847
L. 9	L. 7	17	About 300	324	324	1868	1868

* About. † Probably.

TABLE II.—*Statistics of instruction in chemistry*

Name of institution.	Post-office address.	No. of teachers. Number in chemistry.	Number in physics.	Total number for both branches.	Do these teachers instruct in other subjects?	Grade of the course in which these studies are begun. Chemistry.	Physics.
1	2	3	4	5	6	7	8
INSTITUTIONS FOR SUPERIOR INSTRUCTION OF WOMEN—Cont'd.							
Ferry Hall, Lake Forest University	Lake Forest, Ill	1	1	1	Yes	Junior	Junior
Rockford Seminary	Rockford, Ill	1	1	1	Yes	Junior	Sophomore
Moravian Seminary for Young Ladies	Hope, Ind	1	1	1	Yes	Senior	Junior
College of the Sisters of Bethany	Topeka, Kans	2	2	2	Yes	Mid. Collegiate	Mid. Collegiate
Georgetown Female Seminary	Georgetown, Ky	2	2	...	Yes	Junior	Junior
Daughter's College	Harrodsburg, Ky	1	1	...	Yes	Sophomore	Sophomore
Lexington Baptist Female College	Lexington, Ky	1	1	1	Yes	Junior	Sophomore
Shelbyville Female College	Shelbyville, Ky	1	1	1	Yes	Junior	Freshman
Stanford Female College	Stanford, Ky	1	1	2	Yes	Collegiate	Collegiate
Silliman Female Collegiate Institute	Clinton, La	1	1	1	Yes	Junior	Sophomore
Maine Wesleyan Seminary and Female College	Kent's Hill, Me	1	1	1	Yes	...	...
Baltimore Female College	Baltimore, Md	1	1	1	Yes	4th year	2d year
Abbott Academy	Andover, Mass	2	2	3	Yes	3d year	3d year
Laselle Seminary for Young Women	Auburndale, Mass	1	1	1	Yes	Junior	Sophomore
Gannett Institute	Boston, Mass	2	2	2	...	...	...
Bradford Academy	Bradford, Mass	1	1	1	Yes	3d year	3d year
Wheaton Female Seminary	Norton, Mass	1	1	1	No	Junior	Junior
Maplewood Institute	Pittsfield, Mass	1	1	1	Yes	Junior	Junior
Mount Holyoke Female Seminary	South Hadley, Mass	2	2	2	Yes	3d year	3d year
Whitworth Female College	Brookhaven, Miss	1	1	2	Yes	...	...
Central Female Institute	Clinton, Miss	1	1	1	Yes	Junior	Junior
Stephens College	Columbia, Mo	1	1	1	Yes	...	...
St. Louis Seminary	Jennings, Mo	1	1	1	Yes	...	...
Robinson Female Seminary	Exeter, N. H	1	1	2	Yes	Grammar	Academic
New Hampshire Conference Seminary and Female College	Tilton, N. H	1	1	1	Yes	2d year	Preparatory
Tilden Ladies' Seminary	West Lebanon, N. H	1	1	2	Yes	...	...
Bordentown Female College	Bordentown, N. J	1	1	1	...	Junior	Sophomore
St. Agnes' School	Albany, N. Y	1	1	1	No	Senior	Senior
Brooklyn Heights Seminary	Brooklyn, N. Y	2	2	2	Yes	Senior	Senior
Packer Collegiate Institute	Brooklyn, N. Y	2	3	3	Yes	...	...
Buffalo Female Academy	Buffalo, N. Y	1	1	2	Yes	Academic	Academic
St. Joseph's Academy	Lockport, N. Y	2	2	3	Yes	3d grade	3d grade
Academy of Mt. St. Vincent on the Hudson	New York, N. Y	2	6	6	Yes	...	...
Chowan Baptist Female Institute	Murfreesboro', N. C	1	2	2	Yes	Senior	Sophomore
Thomasville Female College	Thomasville, N. C	...	...	...	...	Senior	Junior
Bartholomew English and Classical School for Young Ladies	Cincinnati, Ohio	1	1	...	No	4th year	4th year
Cincinnati Wesleyan College	Cincinnati, Ohio	1	1	1	Yes	Sophomore	Sophomore
Cleveland Female Seminary	Cleveland, Ohio	1	1	1	Yes	Junior	Junior
Glendale Female College	Glendale, Ohio	1	1	2	Yes	Sophomore	Sophomore
Young Ladies' Institute	Granville, Ohio	1	1	...	Yes	Junior	Junior
Hillsboro' Female College	Hillsboro', Ohio	1	1	...	Yes	...	...
Western Female Seminary	Oxford, Ohio	1	1	...	Yes	3d year	3d year
Lake Erie Seminary	Painesville, Ohio	1	1	2	Yes	3d year	2d year
Moravian Seminary for Young Ladies	Bethlehem, Pa	1	1	...	Yes	Senior	Senior
Wilson College	Chambersburg, Pa	1	1	1	Yes	Junior	Academic
Pennsylvania Female College	Collegeville, Pa	1	1	1	...	...	...
University Female Institute	Lewisburg, Pa	2	1	2	Yes	Sophomore	Sophomore
Brooke Hall Female Seminary	Media, Pa	2	2	2	Yes	2d year	2d year
Pittsburgh Female College	Pittsburgh, Pa	1	1	1	Yes	1st collegiate	1st collegiate

***and physics in secondary schools, &c.*—Continued.**

Course of study.		Average age of pupils beginning these studies.	Approximate value of chemical and physical apparatus.	Text books used.		Instruction began.	
Chemistry.	Physics.			In chemistry.	In physics.	Chemistry.	Physics.
9	10	11	12	13	14	15	16
...	...	18	$2, 000	120, 238, 260	13	1859	1859
K. 7	7	18	1, 100	124, 140, 233	39	1849	1849
9	7	17–18	250–300	178, 190	39	1868	1868
K. 9	M. 7	16–19	500–600	190	45	1865	1865
9	7	17–18	...	178	...	*1839	*1839
7	7	16	500	137, 204, 226	...	1857	1857
9	7	15	50	190	42	1869	1869
9	7	15–16	350	197	53	1854	1854
9	7	15	...	190	32	...	...
8	7	13	250	178	45	...	...
K. 7 t.	K. 6	18	2, 000	141	33	*1824	*1824
9	7	...	...	190	37	...	...
M. 9	M. 7	17	300	182	42	1829	1829
8	7	17–18	350–400	204	38	1851	1851
9	7	17	600	141, 190	2	...	...
K. 8 t.	6	17	1, 000	141, 212, 265	32	†1876	...
6 t.	K. 7	17	Phys. 400	133, 140, 212, 233	...	*1839	*1839
9	7	16–17	500	190	45	1846	1846
8 t.	6	20	2, 400	124	13	1837	1837
9	7	16	2, 000	178	2	‡1867	‡1867
9	7	17	1, 200	191	2, 39	1854	1854
...	...	16	...	137, 175	7, 32	...	...
...	...	18	...	190	53	...	...
9	7	15–18	360	190	32	1875	1875
9	7	16	200	204	32	1845	1845
M. 9	M. 7	16–18	500	190	2	...	...
M.	M.	...	...	...	...	...	...
9	7	16	500	141	37	1870	1870
9	7	16	5, 000–8, 000	137	41	1851	1851
8 t.	7	15–17	6, 500	157, 162	7, 41	1846	1846
9	7	15	500	324	324	...	...
8	7	16–18	600	204	6, 53	1869	1869
8	7	12–14	2, 000	190	45	1847	1847
L. 9	I. 7	15–17	3, 000	204	28, 29	1848	1848
...	...	14	...	197	2	§1874	§1874
8	7	16	800	141	38	1877	1877
7 t.	7	15	1, 500	182	41	†1876	...
L. 9	L. 7	17	1, 000	197, 204	39	1854	1854
9	7	15–16	500	Not fixed	Not fixed	...	...
M. 9	M. 7	18	...	124	41	§1852	§1852
K. 9	M. 7	16	500	141	38	...	...
9	7	17	350–400	124	38	1855	1855
M. 8	M. 7	19	500	168	14	1858–9	1858–9
9	7	16	800	190	45	...	...
L. 7 t.	7	15–20	150	183	45	...	...
9	7	15	1, 200–1, 500	204	2	1851	1851
9	7	18	2, 000	...	...	*1852	*1852
...	...	15	1, 000	204	2, 15	1856	1856
9	7	12	600–700	182	41	1855	1855

* About. † Laboratory. ‡ Probably. § As early as.

TABLE II.—*Statistics of instruction in chemistry*

Name of institution.	Post-office address.	No. of teachers. Number in chemistry.	Number in physics.	Total number for both branches.	Do these teachers instruct in other subjects?	Grade of the course in which these studies are begun. Chemistry.	Physics.
1	2	3	4	5	6	7	8
INSTITUTIONS FOR SUPERIOR INSTRUCTION OF WOMEN—Cont'd.							
Due West Female College	Due West, S. C	1	1	2	Yes.	Senior	Senior
Greenville Female College	Greenville, S. C	1	1	1	Yes	Sophomore	Sophomore
Walhalla Female College	Walhalla, S. C	0	1	1	Yes.		1st collegiate
Athens Female Seminary	Athens, Tenn	1	1	....	Yes.		
Brownsville Female College	Brownsville, Tenn	1	1	1	Yes.	1st collegiate	1st collegiate
Tennessee Female College	Franklin, Tenn	1	1	1	Yes.		
Memphis Conference Female Institute.	Jackson, Tenn	1	1	....	Yes.	Next to highest	Next to highest
Cumberland Female College	McMinnville, Tenn	1	2	3	Yes.	Junior	Junior
Soule Female College	Murfreesboro', Tenn	1	1	....	Yes.	Junior	Junior
W. E. Ward's Seminary for Young Ladies.	Nashville, Tenn	1	1	1	Yes	Junior	Sophomore
Rogersville Female College	Rogersville, Tenn	1	1	1	Yes.		
Mary Sharp College	Winchester, Tenn	1	1	1	Yes	Junior	Sophomore
Andrew Female College	Huntsville, Tex	1	1	1	Yes.		
Baylor Female College	Independence, Tex	..	..	....			
Waco Female College	Waco, Tex	1	1	1	Yes.	Junior	Sophomore
Albemarle Female Institute	Charlottesville, Va	1	1	1	Yes	Sub-senior	Sub-senior
Roanoke Female College	Danville, Va	1	1	1	Yes.	Intermediate	Intermediate
Marion Female College	Marion, Va	1	1	1	Yes	1st collegiate	1st collegiate
Petersburg Female College	Petersburg, Va	1	1	1	Yes.	Collegiate	Collegiate
Southern Female College	Petersburg, Va	1	1	1	Yes.		
Episcopal Female Institute	Winchester, Va	1	1	1	Yes		
Wheeling Female College	Wheeling, W. Va	1	1	....	No..		
Wisconsin Female College	Fox Lake, Wis	1	1	1	Yes.	Ungraded	Ungraded
Milwaukee College	Milwaukee, Wis	2	2	2	Yes.	Senior	Junior
St. Clara Academy	Sinsinawa Mound, Wis.	3	6	7	Yes.	Intermediate	Intermediate
UNIVERSITIES AND COLLEGES.							
Southern University	Greensboro', Ala	1	1	1	Yes.	Senior	Junior
Howard College	Marion, Ala	1	1	2	Yes.	Junior	Senior
Spring Hill College	Near Mobile, Ala	1	1	2	Yes.	6th year	6th year
University of Alabama	Tuscaloosa, Ala	1	1	2	1 does		
Cane Hill College	Boonsborough, Ark	..	..	....	......	Junior	Jun. prep
Judson University	Judsonia, Ark	1	1	2	Yes.	Sen. prep	Jun. prep
St. John's College of Arkansas	Little Rock, Ark	1	1	1	......		
Missionary College of St. Augustine.	Benicia, Cal	1	1	2	Yes	Scientific	Scientific
Pierce Christian College	College City, Cal	1	1	1	Yes.	Freshman	Freshman
University of California	Oakland, Cal	4	2	6	No..	Freshman	Sophomore
St. Ignatius College	San Francisco, Cal	2	1	2	......		
St. Mary's College	San Francisco, Cal	1	2	2	Yes.	2d class jun	3d class soph
Santa Clara College	Santa Clara, Cal	1	1	2	Yes		
Pacific Methodist College	Santa Rosa, Cal	1	1	1	Yes.	Junior	Senior
California College	Vacaville, Cal	1	..	....	......		Junior
Washington College	Washington, Cal	..	..	....	......	Sophomore	Junior
Hesperian College	Woodland, Cal	1	1	1	Yes	Sophomore	Sophomore
Colorado College	Colorado Springs, Colo.	1	1	....	Yes.	Sophomore	Sophomore
Trinity College	Hartford, Conn	1	1	2	Yes	Senior	Sophomore
Wesleyan University	Middletown, Conn	2	2	4	......	Junior	Sophomore
Yale College	New Haven, Conn	1	3	....	......	Sophomore	Sophomore
Delaware College	Newark, Del	1	1	2	Yes.		Junior
University of Georgia	Athens, Ga	2	1	3	Yes.		
Atlanta University	Atlanta, Ga	1	1	1	Yes.	2d year normal	2d year normal
Gainesville College	Gainesville, Ga	..	..	....	......	Junior	Sen. prep
Mercer University	Macon, Ga	1	1	1	Yes.	Senior	Junior

and physics in secondary schools, &c.—Continued.

Course of study.		Average age of pupils beginning these studies.	Approximate value of chemical and physical apparatus.	Text books used.		Instruction began.	
Chemistry.	Physics.			In chemistry.	In physics.	Chemistry.	Physics.
9	10	11	12	13	14	15	16
9	7	17		190	34 or 35?		
M. 9	M. 7	14–16		190	17?		
	9	15			34 or 35?		
	7	18		204	39		
9	7	17	$1,000	124, 143	38, 46	1855	1855
9	7	16–20	250	204	39	1869	1869
9	7	16–17	8,000	161, 183, 204	38	1843	1843
9	7	20	200	120, 190	45	*1850	*1850
11	9	20		190			
8	7	16	1,500	140	38	1865	1865
9	7	15–20	500	190	45	1849	
9	7	15–17	600–700	124		*1850	*1850
9	7	16	1,000	190	45		
				190	45		
9	7	14–16	325		2, 49, 328	1876	1876
L.	I.	15		190	39	1857	1857
9	7	15	250	204	53	1859	1859
9	7	15	200	190	45	1873	1873
9	7	15	500	190	38	1857	1857
		15	500		41		
9	7	15–16	400	197	53	1874	1874
		18				1850	1850
9 or 11	7 or 9	17	50	190	33		
I. 7 t.	I. 7	17–18	3,000	140, 235	13	†1874	1874
		12	500	204	45		
I. 7	G.			212	35		
I. 7	G.				35		
				160 or 161	13, 44		
E. 6 t.	E. 4	18	7,500	124, 155, 162, 183, 260, 262	35, 38	1831	1831
I.	I.						
9	7	20	500	182, 190	2, 35, 41	1875	1875
8	7	18	100	190	45	1867	1867
L.	L.			190	39 or 45		
B. 2, 3, 4, t.	C. 4	18	20,000	140, 183, 212, 230, 238, 260, 262.	35	1869	1869
E. 6 t.	E. 4	16–20	Over 50,000	157, 184, 226	13		
I. 9	I. 7	15		190	45		
9	7	18–22	500	178, 204	35, 39, 45	1871	1871
	I. 4				35		
L.	L.						
9	7	17	500	197		1865	1865
I. 6, 13, 14	I.			140	13		
I. 9 t.	G. 7	19–20	4,000–5,000	112, 168	13, 63	1823–4	1823–4
C. 6 t.	E. 4	19–20		140, 183, 214, 238, 260, 262, 291, 297, 304, 321.	9, 72	1831	1831
L. 9 t.	E. 3			124	13	1802	
E. 6, 20, t.	E. 7			140, 183, 238, 252, 258, 260, 273.	44		
E. 6, 20, t.	E. 4		25,000	143	13, 62	‡1800	1800
M. 9	K. 7	16	550	190, 204	38, 46	1872	1872
I.	I.			204	39		
L.	G.			183	13		

*About †Reorganized. ‡Laboratory 1870.

TABLE II.—*Statistics of instruction in chemistry*

Name of institution.	Post-office address.	No. of teachers. Number in chemistry.	Number in physics.	Total number for both branches.	Do these teachers instruct in other subjects?	Grade of the course in which these studies are begun. Chemistry.	Physics.
1	2	3	4	5	6	7	8
UNIVERSITIES AND COLLEGES—Continued.							
Pio Nono College	Macon, Ga	1	1	1	Yes	Freshman	Freshman
Emory College	Oxford, Ga	1	1	1	Yes	Senior	Junior
Abingdon College	Abingdon, Ill	1	1	1	Yes		
Hedding College	Abingdon, Ill	1	1	1	Yes	Freshman	Junior
Illinois Wesleyan University	Bloomington, Ill	1	1		Yes	Senior prep	
St. Viateur's College	Bourbonnais Grove, Ill.	1	1	1	Yes	6th year	5th year
Blackburn University	Carlinville, Ill	1	1	1	Yes	Junior	Senior
Carthage College	Carthage, Ill	1	1	1	Yes	Middle junior	Sub-freshman
St. Ignatius College	Chicago, Ill	2	1	2	No		
University of Chicago	Chicago, Ill	1	2	3	1 does		1st year prep
Rock River University	Dixon, Ill	1	1	1	Yes		
Eureka College	Eureka, Ill	1	1	1	Yes	Sophomore	Senior
Northwestern University	Evanston, Ill	2	1	2	No	College	Preparatory
Ewing College	Ewing, Ill	1	1	1	Yes	Freshman	Junior
Knox College	Galesburg, Ill	1	1	2	Yes	Junior	Sophomore
Lombard University	Galesburg, Ill	2	2	2	Yes	Junior	Junior
Illinois College	Jacksonville, Ill	1	1	1	Yes	Sophomore	Sophomore
Swedish American Ansgari College.	Knoxville, Ill	1	1	1	Yes	Junior	Sophomore
Lake Forest University	Lake Forest, Ill	1	1	1	Yes	Senior	Junior
McKendree College	Lebanon, Ill	1	1	1	Yes	Junior	Sophomore
Lincoln University	Lincoln, Ill	1	1		No		
Monmouth College	Monmouth, Ill	1	1	1	Yes	Junior	Junior
Northwestern College	Naperville, Ill	1	1	1	Yes	Junior	Junior
Augustana College	Rock Island, Ill	1	1	1	Yes	Junior	Freshman
St. Joseph's Ecclesiastical College.	Teutopolis, Ill					5th year	5th year
Shurtleff College	Upper Alton, Ill	1	1	2	Yes	Junior	Junior
Westfield College	Westfield, Ill	1	1	1	Yes	Junior	Junior
Wheaton College	Wheaton, Ill	1	1	2	Yes	Senior	Sophomore
Bedford College	Bedford, Ind	1	1	1	Yes	Sophomore	Sophomore
Indiana University	Bloomington, Ind	2	1	3	No	Sophomore	Junior
Wabash College	Crawfordsville, Ind.	1	1	2		Junior	Junior
Fort Wayne College	Fort Wayne, Ind	1	1	1	Yes	2d year	2d year
Franklin College	Franklin, Ind	1	1	1	Yes	Junior	1st preparatory
Indiana Asbury University	Greencastle, Ind	1	2	2	Yes	Freshman	Junior
Hanover College	Hanover, Ind	1	1	2	Yes	Junior	Junior
Hartsville University	Hartsville, Ind	1	1	1	Yes	Senior	Senior
Butler University	Irvington, Ind	2	2	3	No	Junior	Junior
Smithson College	Logansport, Ind	1	1	1	Yes	Junior	Junior
Union Christian College	Merom, Ind	1	1	2	Yes	Senior	Senior
Moore's Hill College	Moore's Hill, Ind	1	1	1	Yes	Sophomore	Preparatory
University of Notre Dame du Lac.	Notre Dame, Ind	1	1	1	Yes	Junior	Junior
Earlham College	Richmond, Ind	1	1	2		Freshman	Preparatory
Ridgeville College	Ridgeville, Ind	1	1	1	Yes		
St. Meinrad's College	St. Meinrad, Ind						Junior
Algona College	Algona, Iowa	1	1	1	Yes	Junior	Senior
Amity College	College Springs, Iowa.	1	1	1	Yes		
Griswold College	Davenport, Iowa	1	1		Yes	Junior	Junior
Norwegian Luther College	Decorah, Iowa	0	1	1	Yes		
University of Des Moines	Des Moines, Iowa	1	1	2	Yes	Junior	Junior
Parsons College	Fairfield, Iowa	1	1	1	Yes	Senior	Junior
Upper Iowa University	Fayette, Iowa	1	1	1	Yes	Sophomore	Sophomore
Iowa College	Grinnell, Iowa	1	1		Yes	Freshman	
Humboldt College	Humboldt, Iowa	1	1	1	Yes	Preparatory	Preparatory
Simpson Centenary College	Indianola, Iowa	2	2	2	Yes	Junior	Junior
Iowa State University	Iowa City, Iowa	2	2	2	No	Freshman	Freshman

and physics in secondary schools, &c.— Continued.

Course of study.		Average age of pupils beginning these studies.	Approximate value of chemical and physical apparatus.	Text books used.		Instruction began.	
Chemistry.	Physics.			In chemistry.	In physics.	Chemistry.	Physics.
9	10	11	12	13	14	15	16
E. 9	E. 7	15–16	$600	140, 190	13, 45	1874	1874
L.	I.	...	...	141	35	...	...
M.	M.	...	...	204	7	...	...
M.	I.	...	...	204	9	...	...
E. 9	E. 7	18	...	192, 204	38, 45, 112	1850	1850
...	...	...	...	...	...	...	...
K.	K.	...	...	...	35	...	...
G. 9	G. 7	16–18	700	124	13 or 14, 45	1872	1870
C. 6 t.	C. 4	18	5, 300	124, 238, 260, 265	9	1873	1873
E.-C. 6 t.	I. 7	13–15	700–800	124, 210, 238	2, 35, 38	*1861	*1861
L.	J.	...	...	204	38	...	...
K. 9	K. 7	20	2, 000	124, 190	32, 44	1855	1855
F. 6 t.	I. 4	†20	3, 000	183, 223, 238	9	...	...
M.	K.	...	...	190, 204	7, 63	...	...
K.	K.	...	...	124	35	...	...
7	4	22	6, 000	124, 157	35	...	...
9	J. 4	18–19	4, 000	124	35	1829	1829
...	...	...	...	...	...	...	...
B. 6 t.	4	18	2, 000	120, 238, 260	13	1878	1878
M. 9	M. 7	...	...	...	...	...	...
...	...	20	1, 000	...	...	1866	1866
M. 9.	K.	...	...	204	35	...	...
K. 8	K. 7	18–20	400–500	124, 204	41	1862	1862
9	7	21	500	157, 204	30	1875	1870
...	...	...	...	190	37	...	...
K. 9	K. 4	...	...	204	35	...	...
M. 9	I. 4	...	...	124, 204	35, 53	...	...
M.	K.	...	...	...	...	...	...
9	7	20	100	204	32	1872	1872
D. 6, 13, t.	F. 4	20	5, 000	175, 208, 211, 238, 260, 266, 268.	13	1828	1828
I. 6 t.	I. 4	18	3, 000	133, 183, 204, 238, 260	13, 55 or 56, 67	1833	1833
H.	H.	...	...	...	...	...	...
O. 9	O. 7	16–20	750	157	35, 38	1845	1845
7 t.	3, t.	20	2, 000	...	...	1837	1837
8	4	19–20	...	141	13 or 38	*1829	*1829
9	7	20	800	124	32	1852	1852
I. 6 t.	K. 4	21	1, 000	183, 230, 260	44	1860	1860
K.	K.	...	...	...	...	...	...
O. 9	O. 4	18–20	800–1, 000	204	35	1856	...
K. 7 t.	I. 4	18	400	128, 140	39, 44	1857	1857
E. 7	E. 7	...	...	124, 204	32 or 33	...	...
I. 7 t.	7	17–19	500	183, 238, 268	7, 44	‡1861	1862
9	H. 7	18	200	190	35, 45	...	...
...	...	...	...	...	32	...	...
K.	I.	...	...	190	46	...	...
K. 9	K. 7	17	293	204	38	...	...
I. 9	I. 7	22	1, 000	...	44	1859	1859
...	...	...	...	...	...	...	...
...	...	12	...	...	35	*1869	*1869
...	4	18–20	400	...	35, 41	...	1876
K. 9	I. 4	20	400	204	9	1857	1857
E. 6 t.	I. 4	18–20	§2, 000	141	35	1848	1848
...	7	16	200	...	2, 33, 41, 46	1875	1875
M. 9	K. 4	...	...	157	35, 39	...	...
6 t.	3	16–17	*6, 000	155, 156	9, 82	1868	1863

*About. †Chemistry. ‡Qualitative analysis. §Physics.

TABLE II.—*Statistics of instruction in chemistry*

Name of institution.	Post-office address.	No. of teachers. Number in chemistry.	Number in physics.	Total number for both branches.	Do these teachers instruct in other subjects?	Grade of the course in which these studies are begun. Chemistry.	Physics.
1	2	3	4	5	6	7	8
UNIVERSITIES AND COLLEGES—Continued.							
Iowa Wesleyan University	Mount Pleasant, Iowa.	1	1	2	Yes.	Town schools.	Town schools.
Cornell College	Mount Vernon, Iowa.	1	1	1	Yes.		
Oskaloosa College	Oskaloosa, Iowa	2	1	2	Yes	Junior	Preparatory
Penn College	Oskaloosa, Iowa	1	1	1	Yes.	Freshman	Junior
Central University of Iowa	Pella, Iowa	1	1	1	Yes.	Junior	Junior
Tabor College	Tabor, Iowa	1	1		Yes.	Junior	Preparatory
Western College	Western College, Iowa.	1	1	1	Yes	Senior	Junior
St. Benedict's College	Atchison, Kans					5th year	5th year
Baker University	Baldwin City, Kans.	1	1	1	Yes.	Sophomore	Sophomore
Highland University	Highland, Kans	1	1	1	Yes.	Junior	Junior
University of Kansas	Lawrence, Kans	1	1	2		Sophomore	Middle prep.
Lane University	Lecompton, Kans	1	1	1	Yes.	Junior	Junior
Ottawa University	Ottawa, Kans					Junior	Sophomore
Washburn College	Topeka, Kans					Sophomore	Junior
St. Joseph's College	Bardstown, Ky					6th year	6th year
Berea College	Berea, Ky	1	1	1	Yes	Sophomore	Sophomore
Warren College	Bowling Green, Ky.	1	1	1	Yes	Junior	Junior
Cecilian College	Cecilian P. O., Ky						
Centre College	Danville, Ky	1	1	1	Yes	Junior	Junior
Eminence College	Eminence, Ky	1	1	2	Yes		
Kentucky Military Institute	Farmdale, Ky	1	1	1	Yes	Junior	Junior
Georgetown College	Georgetown, Ky	1	1	1	Yes.	Junior	Junior
Kentucky Wesleyan College	Millersburg, Ky	1	1	1	Yes	Sophomore	Sub-freshman.
Murray Male and Female Institute.	Murray, Ky					Senior	Freshman
Concord College	New Liberty, Ky	1	1	1	Yes.	1st year	1st year
Central University	Richmond, Ky	1	1	1	No.	Junior	Junior
Bethel College	Russellville, Ky	1	1	1	Yes.	Senior	Junior
St. Mary's College	St. Mary's, Ky					4th year	1st year
Louisiana State University	Baton Rouge, La	1	1	2			
Centenary College of Louisiana	Jackson, La	1	1	1	Yes	Junior	Junior
Leland University	New Orleans, La	1	1			2d year	1st year
Straight University	New Orleans, La	0	1	1	Yes		
Jefferson College (St. Mary's)	St. James Parish, La.	1	1	2	Yes.	3d classical	3d classical
Bowdoin College	Brunswick, Me	2				Sophomore	Junior
Bates College	Lewiston, Me	1	1	2	Yes		
Colby University	Waterville, Me	1	1	2	Yes.	Sophomore	Sophomore
St. John's College	Annapolis, Md	1	1	1	Yes.	Senior	Sophomore
Johns Hopkins University	Baltimore, Md	4	2	6	No.	1st year	1st year
Loyola College	Baltimore, Md	1	1	2	Yes.		
Washington College	Chestertown, Md	1	1	1	Yes.	Senior	Junior
Rock Hill College	Ellicott City, Md					Freshman	Freshman
Frederick College	Frederick City, Md.	1	2	3	Yes	Freshman	Freshman
Western Maryland College	Westminster, Md	1	1	1	Yes.	Sophomore	Junior
Amherst College	Amherst, Mass	2	1	3	No.	Sophomore	Sophomore
Boston University, College of Liberal Arts.	Boston, Mass	1	1	2			
Harvard College	Cambridge, Mass	9	5	14	No.	Freshman	Freshman
Tufts College	College Hill, Mass.	1	1	2	Yes.	Junior	Sophomore
Smith College	Northampton, Mass.	1	1	2	No.	Sophomore	Junior
Wellesley College	Wellesley, Mass	1	1	2	Yes	Sophomore	Junior
Williams College	Williamstown, Mass	1	2	3		Junior	Junior
College of the Holy Cross	Worcester, Mass	1	1	1		6th year	
Adrian College	Adrian, Mich	1	1	1	No.	Preparatory	Preparatory
Albion College	Albion, Mich	1	1	1	Yes.	Junior	Sophomore
University of Michigan	Ann Arbor, Mich	5	2	6	No.	Optional	Optional
Battle Creek College	Battle Creek, Mich.	1	1	2	Yes.	Last year	Last year

and physics in secondary schools, &c.—Continued.

Course of study.		Average age of pupils beginning these studies.	Approximate value of chemical and physical apparatus.	Text books used.		Instruction began.	
Chemistry.	Physics.			In chemistry.	In physics.	Chemistry.	Physics.
9	10	11	12	13	14	15	16
6 t.	I. 4	18	$2,500	134, 157	9, 39	1854	1854
I. 6 t.	I. 3	17	1,300	124, 226, 262	13	1858	1858
7	7	18	160	204, 252?	35, 38		
I. 7	M. 7			141, 157, 235, 238, 255	28, 32, 35, 41		
M.	M.				32		
I. 7 t.	I. 7	18	500	141, 230	7, 35	*1870	*1870
M.	M.			178	35		
9	7	18–25		183, 190	13	1860	1860
K.	K.		1,800				
E. 6, 17, t.	I. 4	18	1,500	124, 173	7, 35	1866	1866
K.	K.						
L.	L.						
M.	K.			188	44		
M.	I.	15–22	300	124	35, 38	*1856	*1856
L.	I.						
				157			
6 t.	4	19	3,000	124, 223, 238, 262, 266, 295	35	*1826	*1826
9	7			197	53		
7		17–18	650	124, 223	2, 77, 83, 109	1850	1850
L. 9	I. 4	18	3,000	178	35	*1830	*1830
I. 8	G. 7, 4	16–18	500	141, 162	32, 35	1866	1866
L.	L.						
		17	150	197	53	1868	1868
E. 6 t.	I. 4	16	3,000	143, 238, 260	13, 52, 79, 85	1874	1874
L. 9	I.						
					37		
K. 6, 19				183	3, 44, 55, 62, 91		
I. 9, 20				316	35		
M.	M.						
None.	9				45		
C. 7	C. 7	15	10,000	161	32	1864	1864
F. 7 t.	K.					1805	
L.	K.			140	35		
I. 7 t.	K. 4	18	7,000	140, 199, 241	35		1818
I. 9	E. 4	16–18	2,500–3,000	143	13		
A. 1 t.	A. 1 t.			214, 239, 258, etc	13, 106, etc	1876	1876
10	8		300–400	None	None	1852	1852
9	7	18–20	900	204	30	1782	
				124, 183	28, 63		
9	7	14	500	204	7, 53		
I. 9	I. 7	17	500	143, 178		1869	1869
E. 6, 15, 16, t	E. 2 t.	19	10,000	152, 240, 258	9, 13, 26, 68, 75, 76, 86	1821	1821
I. 7 t.	K. 3	21–22				1873	1873
A. 1 t.	A. 1 t.	18		136, 212, 241, etc		1782	
E. 6 t.	E. 3 t.	20–21	3,000–3,500	192, 223, 230, 252, 262	13, 52, 58, 117	*1855	*1855
C. 6 t.	E. 3 t.		8,000	140, 233, 265	13		
B. 6 t.	E. 3 t.	18	7,500	251	13, 117		
M. 9 t.	K. 7	19–20	5,000	141	32	1830	1803
L.				127			
I. 7	I. 4	20	1,500–2,000	140, 175, 223, 235	33, 35	1859	1859
K.	K.						
A. 1, 3, t.	2 t.	21		260, 265, 266, 268, etc	9, 117		
9	7	17	2,000	124, 204	32	1873	1873

*About.

TABLE II.—*Statistics of instruction in chemistry*

Name of institution.	Post-office address.	No. of teachers. Number in chemistry.	No. of teachers. Number in physics.	No. of teachers. Total number for both branches.	Do these teachers instruct in other subjects?	Grade of the course in which these studies are begun. Chemistry.	Grade of the course in which these studies are begun. Physics.
1	2	3	4	5	6	7	8
UNIVERSITIES AND COLLEGES—Continued.							
Grand Traverse College	Benzonia, Mich	0	1	1	Yes	....	Preparatory
Hillsdale College	Hillsdale, Mich	1	1	2	Yes	Sophomore	Sophomore
Hope College	Holland City, Mich.	1	1	2	Yes	Junior	Junior
Kalamazoo College	Kalamazoo, Mich	1	2	3	Yes	Sophomore	Sophomore
Olivet College	Olivet, Mich	1	1	2	Yes	Junior	Junior
University of Minnesota	Minneapolis, Minn.	1	1	2	1 does	Freshman	Sub-Freshman.
Carleton College	Northfield, Minn	2	2	2	Yes	Freshman	Sen. Prepara'y
St. John's College	St. Joseph, Minn	1	1	1	Yes	....	....
Mississippi College	Clinton, Miss	1	1	1	Yes	3d year	4th year
Shaw University	Holly Springs, Miss.	1	1	1	Yes	Freshman	Freshman
University of Mississippi	Oxford, Miss	2	1	3	Yes	Junior	Junior
Alcorn University	Rodney, Miss	0	1	1	Yes	Junior	Junior
University of the State of Missouri.	Columbia, Mo	1	2	3	1 does	....	Sophomore
Central College	Fayette, Mo	1	2	2	Yes	Junior	Sophomore
Lewis College	Glasgow, Mo	1	1	1	Yes	Preparatory	Sophomore
Pritchett School Institute	Glasgow, Mo	1	1	2	Yes	Grammar sch	Grammar sch
Lincoln College	Greenwood, Mo	1	1	1	Yes	Junior	Junior
La Grange College	La Grange, Mo	1	1	2	Yes	Junior	Junior
William Jewell College	Liberty, Mo	1	1	1	Yes	Junior	Sophomore
Baptist College	Louisiana, Mo	1	1	1	Yes	Junior	Junior
St. Louis University	St. Louis, Mo	1	1	2	No	....	....
Washington University	St. Louis, Mo	1	1	2	No	Sophomore	Freshman
Drury College	Springfield, Mo	1	1	2	Yes	Sophomore	Preparatory
Central Wesleyan College	Warrenton, Mo	1	1	1	Yes	Senior	Freshman
Doane College	Crete, Nebr	1	1	1	Yes	Junior	Junior
University of Nebraska	Lincoln, Nebr	2	1	3	Yes	Preparatory	Preparatory
Dartmouth College	Hanover, N. H	2	1	3	No	Junior	Junior
Rutgers College	New Brunswick, N. J.	6	1	7	1 does	Freshman	Freshman
College of New Jersey	Princeton, N. J	3	1	4	......	Senior	Junior
Seton Hall College	South Orange, N.J.	1	1	1	Yes	Sophomore	Freshman
St. Bonaventure's College	Allegany, N. Y	1	1	1	Yes	4th year	3d year
St. Stephen's College	Annandale, N. Y	0	1	1	Yes	....	Junior
Wells College	Aurora, N. Y	1	1	1	Yes	Junior	Sophomore
Brooklyn Collegiate and Polytechnic Institute.	Brooklyn, N. Y	1	2	3	Yes	1st collegiate	4th academic
Canisius College	Buffalo, N. Y	1	1	1	Yes	5th classical	5th classical
St. Joseph's College	Buffalo, N. Y	..	..	....	......	Junior	Freshman
St. Lawrence University	Canton, N. Y	1	1	2	Yes	Junior	Junior
Hamilton College	Clinton, N. Y	1	1	2	Yes	Senior	Junior
St. John's College	Fordham, N. Y	1	1	1	Yes	Junior	Senior
Hobart College	Geneva, N. Y	1	1	....	Yes	....	....
Madison University	Hamilton, N. Y	1	1	1	Yes	Sophomore	Junior
Cornell University	Ithaca, N. Y	6	2	8	No	Sophomore	Sophomore
Ingham University	Le Roy, N. Y	1	1	1	Yes	Junior	Freshman
College of the City of New York	New York, N. Y	2	1	3	No	Sub-Freshman.	Junior
Columbia College	New York, N. Y	2	2	4	No	Sophomore	Junior
College of St. Francis Xavier	New York, N. Y	1	1	1	Yes	Junior	Senior
University of the City of New York.	New York, N. Y	2	1	3	Yes	Sophomore	Junior
Vassar College	Poughkeepsie, N. Y	1	1	1	No	Sophomore	Junior
University of Rochester	Rochester, N. Y	1	1	2	Yes	Junior	Junior
Union College	Schenectady, N. Y	1	3	....	......	Sophomore	Sophomore
Syracuse University	Syracuse, N. Y	1	1	1	No	Freshman	Freshman
University of North Carolina	Chapel Hill, N. C	1	1	2	Yes	2d year	3d year
Davidson College	Davidson College, N. C.	1	1	2	Yes	Junior	Sophomore
Rutherford College	Excelsior, N. C	1	1	2	Yes	....	....

and physics in secondary schools, &c.—Continued.

Course of study.		Average age of pupils beginning these studies.	Approximate value of chemical and physical apparatus.	Text books used.		Instruction began.	
Chemistry.	Physics.			In chemistry.	In physics.	Chemistry.	Physics.
9	10	11	12	13	14	15	16
None.	9	17	......	......	39	......	*1860
I. 9	K. 4	......	......	124	32, 35	......	......
K.	I.	......	......	178	38	......	......
9	7, 11	20	$500	124	2, 35	......	......
K.	K.	......	......	......	35	......	......
C. 6, 17, t.	E. 3, 11	18–20	5, 000	124, 223, 257, 239, 303	13, 63, 117	*1868	*1868
7 t.	O. 7	19	4, 000	128, 140, 204, 233	33, 35	1871	1871
I. 9	E. 7	18–20	1, 000	124	38	1877	1872
......	O.	......	......	......	......	......	......
9 or 11?	7 or 9?	18	......	190	33	1878	1877
E. 6 t.	E. 3 t.	18–19	15, 000–20, 000	134, 140, 143, 228, 260, 266, 295, 303, 311, 312.	13, 63	......	......
......	......	19	500	204	32	1872	1872
6, 15, 19, t.	I. 3	19	5, 000	183, 238, 260, 266, 282	......	1840	1840
9, 20	7	20	2, 500–3, 000	143, 314 or 315	35	1870	1870
I.	I.	......	......	190, 204	32, 63	......	......
7	7	......	1, 000	157, 175, 190, 235, 265	32, 35, 41	1866	1866
9 or 11?	7 or 9?	......	......	204	32	......	......
9	7	18–25	1, 200	......	......	......	......
E. 7	I. 4	20	3, 000	197	32	......	......
9 or 11?	7 or 9?	16	......	204	38	1869	1869
E. 9	E. 7	16½	5, 000	161	35	1827	1827
C. 6, 14, t.	B. 3 t.	16–18	4, 500	183, 235, 238, 260	13, 116	†1857	*1858
K. 7	K. 4	......	......	124	7, 35	......	......
M.	K.	......	......	190	63	......	......
O. 8	O. 7	22	30	124, 141	35	1876	1876
H. 7 t.	I. 7	16	2, 500	124, 137, 235	7, 35	1871	1871
L. 7 t.	G. 3	20–21	7, 000–8, 000	168	13, 22, 71, 117	1820	1782
E. 6 t.	I.	18	6, 500	124, 183, 238, 260, 266	9, 71	......	......
I. 7 t.	E. 3.	......	......	122, 143, 168, 183	......	......	......
L.	G.	......	......	204	38, 55	......	......
......	......	......	......	175	32	......	......
......	K. 4	20	......	......	35	1860	1860
I. 7 t.	L. 7	18	3, 000	124, 223, 238	9	1868	1868
D. 6, 14, t.	E. 4, 11	13–14	6, 700	204, 212, 238, 260, 266	35, 38, 55. 70	1854	1854
I. 9	E. 7	15–16	4, 000	141	39	1876	1876
E.	E.	......	......	......	39	......	......
9	4	19	1, 600	124	35	1872	1864
I. 7, 20, t.	L. 4	......	......	140, 235	13	1812	1812
......	......	......	......	168	13 or 38, 63	......	......
......	......	18	10, 000	......	13	1825	1825
K. 9	K. 4	20	3, 000	124, 183	35	......	......
C. 2, 4, t.	E. 3 t.	18	19, 000	133, 173, 192, 212, 230, 260, 266, 312.	9, 13, 92, 95, 105, 116, 117.	1868	1868
9	7	17	1, 000	None	32	1835	1835
9, 13, t.	G. 7, 11	15–16	15, 000	130, 266	3, 55, 112, 115, 117	1849	1849
E. 9 t.	E.	......	......	143, 183	......	1802	......
9	7	......	......	124	47, 63	......	......
F. 6 t.	K. 7	......	......	139	28	......	......
I. 7 t.	I. 4	18	7, 500	......	......	......	......
7 t.	K. 7	20	3, 000	183, 199, 233, 238, 295	......	1851	1851
6 t.	......	......	25, 000	183, 214, 229, 265	12, 59	1811	1797
O. 8 t.	O. 7	20	......	124, 143	9, 13	*1872	*1872
E. 6 t.	E. 4	19–20	2, 500	143, 162, 183, 238, 260, 311	9, 69	1818	1818
E. 7 t.	E. 4	17–18	3, 000	124, 238	13, 63	1837	1837
9	7	15–25	......	142	......	1854	1854

* About. † Or 1858.

TABLE II.—*Statistics of instruction in chemistry*

Name of institution.	Post-office address.	No. of teachers.			Do these teachers instruct in other subjects?	Grade of the course in which these studies are begun.	
		Number in chemistry.	Number in physics.	Total number for both branches.		Chemistry.	Physics.
1	2	3	4	5	6	7	8
UNIVERSITIES AND COLLEGES—Continued.							
North Carolina College	Mt. Pleasant, N. C	1	1	1	Yes.	Junior	Junior
Trinity College	Trinity, N. C	1	1	1	Yes.	Junior	Freshman
Wake Forest College	Wake Forest, N. C.	1	1	1	Yes		
Weaverville College	Weaverville, N. C.	1	1	2	Yes	Senior	Freshman
Ohio University	Athens, Ohio	1	1	1	Yes.	Junior	Junior
German Wallace College	Berea, Ohio	1	1	1	Yes.	Junior	Freshman
Baldwin University	Berea, Ohio	1	1	1	Yes.	Junior	Freshman
St. Xavier College	Cincinnati, Ohio	1	1	1	Yes.	Next to highest	Next to highest
University of Cincinnati	Cincinnati, Ohio	1	2	2	1 does	Freshman	Freshman
Farmers' College	College Hill, Ohio	1	1	1	Yes.	Sophomore	Freshman
Ohio State University	Columbus, Ohio	2	1	3	......	Preparatory	Preparatory
Ohio Wesleyan University	Delaware, Ohio	1	1	1	No.	Sophomore	Sophomore
Kenyon College	Gambier, Ohio	1	1	1	Yes.	Junior	Junior
Denison University	Granville, Ohio	1	2	3	Yes.	Junior	1st preparatory
Hiram College	Hiram, Ohio	1	2	2	Yes.	Junior	Preparatory
Western Reserve College	Hudson, Ohio	1	1	2	Yes.	Junior	Junior
Marietta College	Marietta, Ohio	1	1	2	Yes.	Junior	Junior
Mt. Union College	Mt. Union, Ohio	..	..	....	......		
Franklin College	New Athens, Ohio	1	1	....	Yes.		
Muskingum College	New Concord, Ohio.	2	2	....	Yes.	Junior	Junior
Oberlin College	Oberlin, Ohio	1	2	3	Yes.	Junior	Sophomore
McCorkle College	Sago, Ohio	1	1	1	Yes.	Junior	Junior
Scio College	Scio, Ohio	..	..	....	......		
Miami Valley College	Springboro', Ohio	1	1	1	Yes.	Junior	Junior
Wittenberg College	Springfield, Ohio	1	1	1	Yes.	Junior	Junior
Heidelberg College	Tiffin, Ohio	1	1	1	Yes.	Junior	Preparatory
Urbana University	Urbana, Ohio	1	1	1	Yes.	Junior	Junior
Otterbein University	Westerville, Ohio	1	1	1	Yes.	Sophomore	Sophomore
Willoughby College	Willoughby, Ohio	1	1	1	Yes.	Junior	Freshman
Wilmington College	Wilmington, Ohio	1	1	1	Yes.	Freshman	Preparatory
University of Wooster	Wooster, Ohio	1	1	1	......	Senior	Junior
Xenia College	Xenia, Ohio	1	1	1	Yes.	Junior	Sophomore
Wilberforce University	Near Xenia, Ohio	..	..	....	......	Junior	Junior
Antioch College	Yellow Springs, Ohio	1	1	2	Yes.	Middle prep	Middle prep
Pacific University	Forest Grove, Oreg	1	1	1	Yes.	3d year	3d year
McMinnville College	McMinnville, Oreg.	1	1	2	Yes.	Sophomore	Sophomore
Christian College	Monmouth, Oreg	1	1	2	Yes.	Sophomore	Freshman
Muhlenberg College	Allentown, Pa	1	1	1	Yes.	Junior	Junior
Lebanon Valley College	Annville, Pa	1	1	1	Yes.	Senior	Junior
Dickinson College	Carlisle, Pa	1	1	1	No.	Sophomore	Sophomore
Pennsylvania Military Academy	Chester, Pa	1	1	....	No.	Sophomore	Freshman
Lafayette College	Easton, Pa	3	1	4	No.	Freshman	Junior
Ursinus College	Freeland, Pa	1	1	2	Yes.	Sophomore	Junior
Pennsylvania College	Gettysburg, Pa	1	1	2	Yes.	Junior	Junior
Thiel College	Greenville, Pa	..	..	....	......	Junior	Junior
Haverford College	Haverford College, Pa.	1	1	1	No.	Freshman	Freshman
Franklin and Marshall College	Lancaster, Pa	1	1	....	Yes.	Junior	Junior
University at Lewisburg	Lewisburg, Pa	2	2	3	Yes.	Sophomore	Sophomore
Allegheny College	Meadville, Pa	1	1	1	Yes.	Freshman	Junior
Mercersburg College	Mercersburg, Pa	1	1	1	Yes.	Sophomore	Junior
Palatinate College	Myerstown, Pa	1	1	1	Yes.		
Newcastle College	Newcastle, Pa	1	1	1	Yes	Junior	Sophomore
Westminster College	New Wilmington, Pa.	1	1	2	Yes.	Junior	Junior
Lincoln University	Oxford, Pa	1	1	1	Yes.	Junior	Sophomore
La Salle College	Philadelphia, Pa	1	3	3	Yes.	Freshman	Freshman
University of Pennsylvania	Philadelphia, Pa	4	2	6	No.	Freshman	Sophomore
Western University of Pennsylvania.	Pittsburgh, Pa	1	1	2	Yes.	Preparatory	Preparatory

***and physics in secondary schools, &c.*—Continued.**

Course of study.		Average age of pupils beginning these studies.	Approximate value of chemical and physical apparatus.	Text books used.		Instruction began.	
Chemistry.	Physics.			In chemistry.	In physics.	Chemistry.	Physics.
9	10	11	12	13	14	15	16
9	7	18	$800	204	13 or 38, 63	*1856	*1856
I. 6	I. 7, 11			197	53		
				191, 316	35		
L.	G. 7, 11			204, 226 or 296?	44, 53, 63, 67		
K. 9	K. 7	17–18	1,800	124, 204	9		
K. 8	K. 7	19		204	33	1864	1864
K.	H. 7, 11			204	33, 63		
E. 9	E. 7	17	2,600	204	44		
A. 1 t.	E. 3	17–18	8,000	183, 205, 214, 238, 258, 260	13, 66, 69, 103	1874	1874
I. 9, 20	G. 7, 11			204	35, 39		
E. 6, 14, t.	E. 3, 11, t.		30,000	175, etc	13, etc	1873	1873
I. 7, 15, 16, t	K. 7	18–19	2,000	162, 183	13	†1806	
M. 9	H. 4		5,000	183	13		
M. 8	I. 4	16	1,200	124	2, 9	1831	1831
M. 9	4	16	300	204	33, 35	1850	1850
H. 7 t.	I. 4	20	7,500	141, 235	13		
8	4	20	5,000	140	35	‡1846	1835
				197	37, 44		
9	7		2,000			*1825	*1825
M.	M.						
G. 7, 13, t.	I. 4	18–20	8,000	141, 230, 265	2, 35	†1878	1834
9	7	18–25	600	204	44	1859	1859
				190, 226	44, 45		
K. 9, 20	M.						
7 t.	4	19	1,000	124, 235	35	1846	1846
9	7	14–18	800	204	33, 35		
K. 8	7	20	600	141	47 with 17	1854	1854
L. 9	I. 4	19–20	4,000	183, 212	35	1856	1856
K. 9	I. 7			204	32, 39		
9	7, 11	17–18	150–200	183	7, 67		
K. 7 t.	I.						
M. 9	M. 7			204	53		
K.	K.						
K. 8 t.	I.	12–15	1,900	143 for reference	2, 27, 58, 105	1853	1853
O. 8	O. 7	18	600	139	35	1862	1862
9	7		2,000	190	35, 38	1861	1861
9	7, 11	14	100	139	35, 37	1869	1869
I. 9	K. 7				13 or 38 ?		
M.	K.			204	35		
E. 6 t.	I. 4	16	6,000	143, 183, 238, 256, 260	9, 13	1811	1783
7 t.	7	16	5,000	124, 223, 230, 266	38	1863	1863
A. 2 t.	I. 4	16–18	12,000	162, 183, 238, 258, 260	9, 13, 35, 66, 93	1837	1832
9	7	20	500	142	35	1869	
H. 7	K. 7						
					29		
B. 6 t.	B. 3 t.	18–19	4,000–5,000	141, 235	9, 32, 117	1833	1833
9	7	17	1,000	204	13 or 38 ?		
O. 9	7	20	1,500	140, 204	2, 35	*1847	*1847
I.	I.						
K. 7	I. 7	20	500	124, 175	32		1878
7				183, 226	53		
H. 7	K. 7	21	1,200	183	13	1852	1852
I.	L.						
A. 7	5 years	16–17	2,000	124, 140, 230			
A. 1 t.	C. 3 t.	15–16	40,000	203, 238, 239, 258, 260	13	{ 1769 †1872 }	
H. 7 t.	L. 4	14		183, 238, 260, 265, 266	13, 41	1819	1819

* About. † Laboratory. ‡ Before.

TABLE II.—*Statistics of instruction in chemistry*

Name of institution.	Post-office address.	No. of teachers.			Do these teachers instruct in other subjects?	Grade of the course in which these studies are begun.	
		Number in chemistry.	Number in physics.	Total number for both branches.		Chemistry.	Physics.
1	2	3	4	5	6	7	8
UNIVERSITIES AND COLLEGES—Continued.							
Lehigh University	South Bethlehem, Pa.	2	1	3	No	Freshman	Freshman
Swarthmore College	Swarthmore, Pa	2	1	2	......	Freshman	Freshman
Augustinian College of St. Thomas of Villanova.	Villanova, Pa	1	2	3	......	......	......
Washington and Jefferson College.	Washington, Pa	1	1	1	......	Junior	Senior
Waynesburg College	Waynesburg, Pa	1	1	2	Yes	......	......
Brown University	Providence, R. I	2	1	3	No	Freshman	Sophomore
College of Charleston	Charleston, S. C	1	1	1	Yes	Senior	Senior
University of South Carolina	Columbia, S. C	1	1	2	Yes	Junior	Freshman
Erskine College	Due West, S. C	1	1	1	Yes	Senior	Junior
Furman University	Greenville, S. C	1	1	1	......	Junior	Junior
Newberry College	Newberry, S. C	1	1	1	Yes	Junior	Junior
Wofford College	Spartanburg, S. C	1	1	2	Yes	Junior	Junior
East Tennessee Wesleyan University.	Athens, Tenn	..	..	....	......	Junior	Sophomore
Beech Grove College	Beech Grove, Tenn	1	1	1	Yes	Junior	Junior
King College	Bristol, Tenn	1	1	2	Yes	Junior	Junior
Southwestern Presbyterian University.	Clarksville, Tenn	1	1	1	No	Sophomore	Sophomore
Hiwassee College	Hiwassee College, Tenn.	1	1	2	Yes	Freshman	Freshman
Southwestern Baptist University	Jackson, Tenn	1	1	1	No	2d year	3d year
East Tennessee University	Knoxville, Tenn	2	2	3	Yes	Freshman	Freshman
Cumberland University	Lebanon, Tenn	1	1	2	Yes	Junior	Junior
Bethel College	McKenzie, Tenn	1	1	1	Yes	Senior	Senior
Manchester College	Manchester, Tenn	1	1	1	Yes	Freshman	Freshman
Maryville College	Maryville, Tenn	..	..	3	Yes	Junior	Junior
Christian Brothers' College	Memphis, Tenn	2	3	4	Yes	Sophomore	Preparatory
Mosheim Institute	Mosheim, Tenn	1	1	1	Yes	......	......
Mossy Creek College	Mossy Creek, Tenn	1	1	2	Yes	Junior	Senior
Central Tennessee College	Nashville, Tenn	1	2	2	Yes	Sophomore	Preparatory
Fisk University	Nashville, Tenn	1	1	1	Yes	......	......
Vanderbilt University	Nashville, Tenn	3	1	4	1 does	Junior	Junior
University of the South	Sewanee, Tenn	1	1	2	Yes	......	......
Tusculum College	Tusculum, Tenn	1	1	1	Yes	Senior	Junior
Texas Military Institute	Austin, Tex	1	1	1	Yes	Next to highest	Next to highest
Southwestern University	Georgetown, Tex	1	1	1	No	Preparatory	Preparatory
Baylor University	Independence, Tex	1	1	2	Yes	Academic	Academic
Salado College	Salado, Tex	1	1	1	Yes	Junior	Freshman
Trinity University	Tehuacana, Tex	1	1	2	Yes	Sophomore	Junior
Waco University	Waco, Tex	1	1	1	Yes	Sophomore	Sophomore
University of Vermont and State Agricultural College.	Burlington, Vt	1	1	2	Yes	Freshman	Freshman
Middlebury College	Middlebury, Vt	1	1	2	Yes	Junior	Junior
Norwich University	Northfield, Vt	1	1	1	Yes	Sophomore	Junior
Randolph Macon College	Ashland, Va	1	1	1	Yes	3d year	2d year
Emory and Henry College	Emory, Va	1	1	1	Yes	Common sch'ls	Common sch'ls
Hampden Sidney College	Hampden Sidney, Va.	1	1	1	......	Junior	Senior
Washington and Lee University	Lexington, Va	1	1	2	......	......	......
Richmond College	Richmond, Va	1	1	2	Yes	......	......
Roanoke College	Salem, Va	1	1	1	Yes	Junior	Junior
University of Virginia	Charlottesville, Va	2	1	3	No	Ungraded	Ungraded
Bethany College	Bethany, W. Va	1	1	1	Yes	......	......
West Virginia College	Flemington, W. Va	1	1	1	Yes	Preparatory	Preparatory
West Virginia University	Morgantown, W. Va	1	1	1	......	Freshman	Sophomore
Lawrence University	Appleton, Wis	1	1	1	Yes	Senior	Junior
Beloit College	Beloit, Wis	1	1	....	Yes	Sophomore	Junior

and physics in secondary schools, &c.—Continued.

Course of study.		Average age of pupils beginning these studies.	Approximate value of chemical and physical apparatus.	Text books used.		Instruction began.	
Chemistry.	Physics.			In chemistry.	In physics.	Chemistry.	Physics.
9	10	11	12	13	14	15	16
B. 2, 3 t.	H. 3 t.	16–17	$20,000	143, 211, 212, 239, 260, 265, 266, 268, 270, 280.	9, 67, 94	1866	1866
B. 6	G.	......	......	212, 252, 266	......	......	......
E.	E.	......	......	......	......	*1855	*1855
H. 7 t.	I.	......	......	183, 235	13	......	......
9	4	......	500	204	3, 7, 35, 55	1851	1851
A. 6 t.	G. 3 t.	20–21	......	120, 192, 219, 222, 223, 257	9, 13, 44, 63	1811	......
......	......	......	800–1,000	183	35	1838	1838
I. 8	E. 7	......	......	140, 212	35	......	......
L.	I.	......	......	191	35	......	......
7	......	......	......	124, 171	1, 63	......	......
9	4	......	100	204	35	1858	1858
9	7	19	600	124	13	1855	1855
L	L.	......	......	204	32	......	......
11	11	15	None	124	35	1869	1869
L.	L.	......	......	204	......	......	......
......	......	17	2,000	140	44	1850	1850
11	9	18	None	197	53	1849	1849
......	......	18	......	183	35, 47	1877	1877
A. 4, 6 t.	E. 7, 11	16–18	2,000	183, 238, 260, 312	47, 71	1839	1839
6 t.	7	16–20	1,500	124, 209, 238, 260, 266, 276	9	1842	1842
I. 11	I. 9	18–25	......	124, 204	38	1847	1847
11	9	18–20	None	161, 190	35, 37, 45	1866	......
9	7	......	2,000–2,300	141	35	*1849	1849
9	7	13–14	1,500	143	39	1874	......
11	9	16	None	204	39	1670	1870
L.	L.	......	......	197	35	......	......
9	7	20	350	190	35, 45	1874	1870
7 t.	7	20	2,000	141	32	1874	1873
E. 6 t.	E. 4	19	30,000	183, 235, 238, 260, 270, 273, 303, 311, 313,	13, 63	1875	1875
E. 7 t.	E. 4	......	......	143, 238	9, 13, 63	......	......
L.	K.	20	150	124	35	1827	1827
9	7	17	300	204	47	......	......
8	6	14	......	183, 184, 212	13, 47, 48	......	......
9	7	14	700	204	35, 38, 325	1846	1846
I.	I.	......	......	......	......	......	......
I.	I.	......	......	......	......	......	......
L.	L.	......	......	122	35	......	......
4, 6 t.	4	18	6,000	124, 141, 238, 260	13, 47	1830	1830
K.	K.	......	......	140	35	......	......
9	4	18–20	......	204	3, 55	1834	1834
I. 9	G. 7, 11	18	800	183, 204	38, 63	1832	1832
9	7	16	4,000	124, 141, 204	35, 45	*1839	*1839
G. 9, 20	L. 7	......	......	183, 204, 316	1	......	......
E. t.	E. 4	......	......	183, 204	47, 55, 91	......	......
9	E. 4	......	......	143	13, 32, 52, 62	......	......
L.	L	......	......	204	35	......	......
1 t.	E. 3 t.	19–21	26,000	143, 238, 260, 311	13, 103, 116, 117	1825	1825
L. 6 t.	L. 7	22	5,000	124, 223, 260, 266	13	......	......
......	......	16	100	124, 140	33, 35	1869	1869
H. 7	F. 7	......	......	140	63	......	......
L. 9	I. 4	20	600	......	9	1849	1849
I. 7 t.	K. 4.	18	1,000	183, 212, 234	13	1847	1847

* About.

TABLE II.—*Statistics of instruction in chemistry*

Name of institution.	Post-office address.	No. of teachers. Number in chemistry.	Number in physics.	Total number for both branches.	Do these teachers instruct in other subjects?	Grade of the course in which these studies are begun. Chemistry.	Physics.
1	2	3	4	5	6	7	8
UNIVERSITIES AND COLLEGES—Continued.							
Galesville University	Galesville, Wis	1	1	1	Yes	Junior	Junior
University of Wisconsin	Madison, Wis	2	2	4	1 does	Junior	Sophomore
Milton College	Milton, Wis	1	1	2	Yes	Sophomore	Sophomore
St. John's College	Prairie du Chien, Wis.	..	1	....	Yes	....	2d class
Racine College	Racine, Wis	1	1	2	Yes	Gram. school	Junior
Ripon College	Ripon, Wis	1	1	1	Yes	Sophomore	Preparatory
Northwestern University	Watertown, Wis	..	..	....	......	Sophomore	Junior
Georgetown College	Georgetown, D. C	1	1	2	No	Sophomore	Senior
Columbian University	Washington, D. C	1	1	1	Yes	Junior	Sophomore
Howard University	Washington, D. C	1	1	1	Yes	2d year prep	2d year prep
National Deaf-Mute College	Washington, D. C	1	1	1	Yes	Sophomore	Junior
University of Deseret	Salt Lake City, Utah.	2	1	1	1 does	Optional	Optional
AGRICULTURAL COLLEGES AND SCIENTIFIC SCHOOLS ENDOWED WITH NATIONAL LAND GRANT.							
State Agricultural and Mechanical College.	Auburn, Ala	2	1	3	Yes	3d class	4th class
Arkansas Industrial University	Fayetteville, Ark	1	2	2	Yes	Freshman	Freshman
Sheffield Scientific School of Yale College.	New Haven, Conn	5	1	6	No	Freshman	Freshman
Illinois Industrial University	Urbana, Ill	5	3	8	Yes	Freshman	Junior
Purdue University	La Fayette, Ind	2	2	2	No	Junior	Sophomore
Iowa State Agricultural College	Ames, Iowa	2	1	3	1 does	Sophomore	....
Kansas State Agricultural College.	Manhattan, Kans	1	1	1	Yes	2d year	2d year
Agricultural and Mechanical College of Kentucky (Kentucky University).	Lexington, Ky	2	2	3	......	....	....
Maine State College of Agriculture and Mechanic Arts.	Orono, Me	1	1	2	......	Sophomore	Junior
Maryland Agricultural College	College Station, Md	1	1	2	No	Freshman	Freshman
Massachusetts Agricultural College.	Amherst, Mass	1	1	2	1 does	Freshman	Junior
Massachusetts Institute of Technology.	Boston, Mass	7	3	10	1 does	1st year	2d year
Michigan State Agricultural College.	Lansing, Mich	2	2	2	Yes	....	....
Missouri School of Mines and Metallurgy (University of Missouri).	Rolla, Mo	1	..	....	......	1st year	1st year
Corvallis State Agricultural College.	Corvallis, Oreg	1	1	2	Yes	....	....
Pennsylvania State College	State College, Pa	1	1	1	No	Sophomore	Junior
Agricultural and Mechanical College of Texas.	College Station, Tex	1	1	2	Yes	....	....
Virginia Agricultural and Mechanical College.	Blacksburg, Va	1	1	2	Yes	2d year	1st year
Hampton Normal and Agricultural Institute.	Hampton, Va	1	1	1	Yes	Senior	Middle class of 3 y'rs' course.
SCIENTIFIC SCHOOLS NOT ENDOWED WITH NATIONAL LAND GRANT.							
Mining Institute as connected with Colorado College.	Colorado Springs, Colo.	1	2	3	Yes	2d year, preparatory.	2d year, preparatory.
State School of Mines	Golden, Colo	1	1	1	Yes	....	....
United States Naval Academy	Annapolis, Md	5	5	5	No	2d year	2d year

and physics in secondary schools, &c.—Continued.

Course of study.		Average age of pupils beginning these studies.	Approximate value of chemical and physical apparatus.	Text books used.		Instruction began.	
Chemistry.	Physics.			In chemistry.	In physics.	Chemistry.	Physics.
9	10	11	12	13	14	15	16
K. 9	K. 7	....	....	197	13 or 38 ?	....	......
E. 6 t.	H. 3 t.	19–21	$5,000	192, 238, 260	9, 102, 117..........	*1868	*1879
9	7	20	1,000	140	33, 35..............	1855	1855
....	7	14	....	....	39.................	....	1871
A. 6 t.	I. 4	17–19	10,000	133, 140, 238, 262, 264, 265	85.................	1852	1852
I. 7 t.	I. 7	15–18	2,000	140, 235	13, 33..............	1865	1865
....	....	....	....	....	....	....	......
E. 7 t.	4	17–20	4,500	127, 183, 295	13, 63..............	1834	†1817
....	....	17–18	....	....	....	....	......
K. 9	I. 7	16–18	1,500	183, 190, 235, 295	35, 38..............	1870	1870
E. 7 t.	K. 6	....	1,000	235	35.................	1864	1864
6, 14	7	18	3,000	182, 190, 226	....	1869	1869
C. 4, 6 t.	E. 4 t.	17–19	5,000	127, 134, 171, 238, 260, 273, 314, 315.	85, 47..............	1872	1872
4, 6 t.	4 t.	16	3,000	140, 167, vol. 3, 238, 315 ..	13.................	1872	1872
C. 1, 4 t.	I. 4 t.	....	....	238, 260, 298	13.................	1847	1847
A, 2, 4, 5 t.	E. 3 t.	18	18,000	168, 183, 233, 238, 260	13, 58, 71	1868	1868
C. 2 t.	E. 3 t.	19	5,000	Only reference books ..	Only reference books.	....	‡1877
C. 4 t.	E. 3 t.	18	8,000 or 9,000	127, 212, 250, 260, 273	13.................	1869	1869
H. 4 t.	L. 7 t.	16	3,000	175, 244, 314	38.................	§1867	§1867
E. 6 t.	E. 4 t.	14	2,000–3,000	141, 314, 315	32, 35..............	....	1794
C. 4, 6 t.	K. 4	19	....	173, 183, 230, 260, 312, 314, 315.	13.................	1869	1869
A. 2, 4 t.	E. 4	16	1,000	204, 238, 256, 314, 315	3, 32, 66, 69.........	1859	1859
F. 4 t.	K. 4	17–18	4,500	157, ? 256, 258, 263	13.................	....	......
A. 1, 2, 3 t.	C. 1 t.	18	15,000	140, 183, 208, 230, 235, 260.	13, 110, 117.........	1865	1865
F. 4 t.	L. 11, 13	18–19	5,000	183, 244, 314, 315	63, 111.............	1857	......
C. 3	....	....	....	127, 175, 212, 238, 259, 260, 263, 266.	38, 63..............	....	......
6 t.	4	17–18	3,000	183, 212, 219, 235	80 or 81, 92, 105	1872	1872
C. 4 t.	4	19	3,500	133, 140, 238, 260, 316	9..................	1860	1860
....	....	....	....	124, 319	63	....	......
9	7	17–18	1,300–1,600	141	32, 39..............	1872	1872
L. 10	L. 7	17	65–95	184	7..................	1870	1869
6 t.	7	14	1,000	141, 238, 262, 265, 267	47, 52, 79, 96........	1875	1875
3	....	21	1,000	124, 238, 260, 270	13.................	....	......
D. 6, 13 t.	E. 3 t.	18	8,100	141, 235, 282, 266	47, 95, 105, 116....	1845 *1875	1845

*Laboratory. † As early as. ‡ Laboratory work. § About.

TABLE II.—*Statistics of instruction in chemistry*

Name of institution.	Post-office address.	No. of teachers. Number in chemistry.	Number in physics.	Total number for both branches.	Do these teachers instruct in other subjects?	Grade of the course in which these studies are begun. Chemistry.	Physics.
1	2	3	4	5	6	7	8
SCIENTIFIC SCHOOLS NOT ENDOWED WITH NATIONAL LAND GRANT—Continued.							
Lawrence Scientific School	Cambridge, Mass	6	5	11	No	1st year	1st year
Bussey Institution (Harvard University).	Jamaica Plain, Mass	1	0	1	No	Freshman	
Worcester Free Institute of Industrial Science.	Worcester, Mass	2	1	3	No	1st year	2d year
Polytechnic School of Washington University.	St. Louis, Mo	1	1	2	No	Sophomore	Before admission.
Stevens Institute of Technology	Hoboken, N. J	2	2	4	No	2d year	1st year
John C. Green School of Science (Princeton College).	Princeton, N. J	3	1	4		Sophomore	Junior
School of Mines of Columbia College.	New York, N. Y	9	2	11	No	1st year	1st year
Rensselaer Polytechnic Institute	Troy, N. Y	2	1	3		2d year	1st year
United States Military Academy	West Point, N. Y	2			No	3d year	3d year
Virginia Military Institute	Lexington, Va	4	4		No	3d year	3d year
Newmarket Polytechnic Institute.	Newmarket, Va						
MEDICAL AND SURGICAL SCHOOLS.							
1. *Regular.*							
Medical College of Alabama	Mobile, Ala	1		1	No		
Medical College of the Pacific (University College).	San Francisco, Cal	1	1	1	No		
Medical department, University of California.	San Francisco, Cal	1	1	1	No	1st course	
Medical Institution of Yale College.	New Haven, Conn	1	1	1	No		
Atlanta Medical College	Atlanta, Ga						
Medical College of Georgia (University of Georgia).	Augusta, Ga	1		1			
Savannah Medical College	Savannah, Ga	1		1			
Chicago Medical College (Northwestern University).	Chicago, Ill	2		2	No	1st year	
Rush Medical College	Chicago, Ill	4		4	No	1st year	
Woman's Hospital Medical College.	Chicago, Ill	1	1	1	No	1st year	
Medical College of Evansville	Evansville, Ind	1	0	1	Yes	Not graded	
Indiana Medical College	Indianapolis, Ind	2	0	2	No		
Medical department of Iowa State University.	Iowa City, Iowa	2		2			
College of Physicians and Surgeons.	Keokuk, Iowa	2		2	Yes		
Hospital College of Medicine (Central University).	Louisville, Ky	1		1	No	1st year	
Kentucky School of Medicine	Louisville, Ky	1		1			
Medical department of the University of Louisville.	Louisville, Ky	2		2	No		
Medical department of the University of Louisiana.	New Orleans, La	1	0	1	Yes		
Medical School of Maine (Bowdoin College).	Brunswick, Me	1		1			
College of Physicians and Surgeons.	Baltimore, Md	1		1			
School of Medicine (University of Maryland).	Baltimore, Md	1		1			
Harvard Medical School (Harvard University).	Boston, Mass	5	0	5	No	1st year	

and physics in secondary schools, &c.—Continued.

Course of study.		Average age of pupils beginning these studies.	Approximate value of chemical and physical apparatus.	Text books used.		Instruction began.	
Chemistry.	Physics.			In chemistry.	In physics.	Chemistry.	Physics.
9	10	11	12	13	14	15	16
A. 1 t.	A. 1 t.	......	......	......	......	1847	......
E. 4 t.	......	17	......	314, 315, etc	......	......	......
C. 2 t.	E. 2 t.	$17\frac{3}{4}$	$18, 000	124	47, 99	1868	1868
A. 2	B. 3	$17-18\frac{1}{2}$	3, 200	183, 235, 238, 260	13, 41, 116	1859	1859
C. 6 t.	A. 1 t.	18	20, 000	143, 235, 238, 260, 262, 266	13, 30, 105	1871	1871
C. 6, 14 t.	E. 3 t.	......	......	......	......	......	......
A. 2, 3 t.	E. 4	......	......	143, 183, 238, 268, 270, 311	13, 63	1864	1864
E. 6 t.	A. 4, 11, 12	......	......	None reported	13, 93, 105	......	......
9 t.	I. 4	20–21	22, 000	143	3, 55	......	......
6	......	18	Chem. 3, 000	162, 183, 238, 260, 267	......	1858	......
......	......	......	......	190	35, 67	......	......
L. 9, 18	......	20	5, 000	143	......	1859	......
L. 9, 15	......	25	1, 500	124, 143, 210, 309	......	......	......
L. 9, 15	13	26	500	143	......	*1858	*1858
5 t.	......	18–19	......	124, 274, 296	......	1813	1813
......	......	......	......	......	......	......	......
L. 8, 18	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......
E. 5 t.	......	23	2, 000	143, 183, 282, 283, 295	......	1859	......
8	......	23–24	1, 000	124, 183, 238, 260, 295	......	1844	......
7, 16	13	25	150	183, 295	......	1871	......
L. 8, 15	......	40	500	143, 238, 295	......	1849	......
7, 17	......	21	3, 500	212, 295, 296	......	......	......
L. 7, 15, 16	......	......	......	143, 156, 283	......	......	......
......	......	......	......	124, 143, 183, 295	......	......	......
17	......	20	500	295	......	1874	......
......	......	......	......	130, 143	......	......	......
8, 15, 17	13	22	1, 000	295	......	1837	......
9	......	22	5, 000	143	......	......	......
L. 9	......	......	......	183, 213, 225, 239, 260	......	......	......
......	......	......	......	......	......	......	......
......	......	......	......	127, 143	......	......	......
E. 5 t.	......	22	5, 000–10, 000	192, 229, 281, 291, 294	113	1782	......

*About.

TABLE II.—*Statistics of instruction in chemistry*

Name of institution.	Post-office address.	No. of teachers. Number in chemistry.	Number in physics.	Total number for both branches.	Do these teachers instruct in other subjects?	Grade of the course in which these studies are begun. Chemistry.	Pyhsics.
1	2	3	4	5	6	7	8
MEDICAL AND SURGICAL SCHOOLS —Continued.							
1. *Regular*—Continued.							
Department of Medicine and Surgery (University of Michigan).	Ann Arbor, Mich	5	0	5	No.	1st college year	
Detroit Medical College	Detroit, Mich	2	0	2	No.	At entrance	
Medical College (University of the State of Missouri).	Columbia, Mo	1	..	1			
Kansas City College of Physicians and Surgeons.	Kansas City, Mo	1	0	1	No.	1st term	
Missouri Medical College	St. Louis, Mo	1	..	1			
St. Louis Medical College	St. Louis, Mo	2	..	2	No.		
New Hampshire Medical Institution (Dartmouth College).	Hanover, N. H	1	..	1			
Albany Medical College (Union University).	Albany, N. Y	2	1	2	No.	1st year	
Bellevue Hospital Medical College.	New York, N. Y	2	..	2			
College of Physicians and Surgeons (Columbia College).	New York, N. Y	2	..	2	No.		
Medical department, University of the City of New York.	New York, N. Y	1	1	1	No.	1st year	
Woman's Medical College of the New York Infirmary.	New York, N. Y	1	..	1	No.		
Medical College of Syracuse University.	Syracuse, N. Y	2	0	2	No.	1st year	
Cincinnati College of Medicine and Surgery.	Cincinnati, Ohio	2	0	2	No.		
Medical College of Ohio	Cincinnati, Ohio	2	2	2	1 does		
Miami Medical College	Cincinnati, Ohio	2	1	2	No.		
Cleveland Medical College (Western Reserve College).	Cleveland, Ohio	1	0	1	No.		
Medical department, Wooster University.	Cleveland, Ohio	2	0	2	No.	Freshman	
Columbus Medical College	Columbus, Ohio	1	..	1	No.		
Starling Medical College	Columbus, Ohio	1	..	1	No.		
Medical department, Willamette University.	Salem, Oreg	1	..	1			
Jefferson Medical College	Philadelphia, Pa	2	..	2			
Medical department, University of Pennsylvania.	Philadelphia, Pa	4	..	4			
Woman's Medical College of Pennsylvania.	Philadelphia, Pa	2	..	2			
Medical College of the State of South Carolina.	Charleston, S. C	1	..	1			
Medical department, Vanderbilt University.	Nashville, Tenn	1	..	1			
Medical department, University of Vermont.	Burlington, Vt	1	..	1			
Medical College of Virginia	Richmond, Va	1	..	1			
Medical department, Howard University.	Washington, D. C	1	..	1	No.		
National Medical College of the Columbian University.	Washington, D. C	1	1	1	No.	Entrance	
2. *Eclectic.*							
Bennett Medical College	Chicago, Ill	2	..	2	No.		
Eclectic Medical College of the City of New York.	New York, N. Y	1	..	1	Yes.		

and physics in secondary schools, &c.—Continued.

Course of study.		Average age of pupils beginning these studies.	Approximate value of chemical and physical apparatus.	Text books used.		Instruction began.	
Chemistry.	Physics.			In chemistry.	In physics.	Chemistry.	Physics.
9	10	11	12	13	14	15	16
E. 5 t.		23		127, 233, 307	111	*1858	
7, 15, 16		22	$2,000	124, 127, 281, 285, 296		1868	
I. 7, 15				143, 282			
7, 15		28	200	143, 295		1869	
				143, 168, 183, 239, 277, 282, 295, 303.			
7 or 9				162, 183			
L. 9							
L. 9 or 7 t.		20		143, 168, 230, 238, 280, 294		1839	1839
9 or 7				143, 183, 282, 284, 296			
9							
L. 9, 17		18–40	12, 500	143, 295, 296	112		
9 or 7			500	238, 309			
E. 5 t.		20	1, 000–2, 000	295		1865	
L. 9 or 7		20–25		282, 283, 295			
L. 9 or 7	14	25	3, 000	143, 183, 287, 295	113, 114	1819	1876
L. 7 t.		Over 21	2, 000	124, 127, 143, 183, 235, 295, 296.		1852	1852
L. 9 or 7		20	500	143, 183			
L. 9 or 7			1, 000	141, 162, 182, 183		*1878	
				143, 205			
				143, 148, 295			
				296, 305			
6, 15, 17				127, 143, 199, 282, 295, 300			
E. 5 t.			12, 000	143, 283, 294, 296		1768	
				143, 168, 282, 284, 294, 295, 303.			
				130, 148			
L. 9							
				124, 143, 296, 309			
				295			
L. 9		25	1, 000	295	88	1868	
L. 9 or 7		20–25	1, 000	124, 127, 143, 281, 282, 295		1822	
9		25	300	124, 143, 295		1869	
				127, 143, 277, 282			

*Laboratory.

TABLE II.—*Statistics of instruction in chemistry*

Name of institution.	Post-office address.	No. of teachers. Number in chemistry.	No. of teachers. Number in physics.	No. of teachers. Total number for both branches.	Do these teachers instruct in other subjects?	Grade of the course in which these studies are begun. Chemistry.	Grade of the course in which these studies are begun. Physics.
1	2	3	4	5	6	7	8
MEDICAL AND SURGICAL SCHOOLS—Continued.							
2. *Eclectic*—Continued.							
Eclectic Medical Institute	Cincinnati, Ohio	1	..	1	No		
3. *Homœopathic.*							
Hahnemann Medical College	Chicago, Ill	2	0	2	No	1st year	
Boston University School of Medicine.	Boston, Mass	1	..	1	No	1st year	
Homœopathic Medical College (University of Michigan).	Ann Arbor, Mich	5	0	5		1st year	
Homœopathic Medical College of Missouri.	St. Louis, Mo	1	..	1			
Missouri School of Midwifery and Diseases of Women and Children.	St. Louis, Mo	1	1	1	Yes		
New York Homœopathic Medical College.	New York, N. Y	1	..	1	No		
Pulte Medical College	Cincinnati, Ohio	1	..	1			
Homœopathic Hospital College	Cleveland, Ohio	2	0	2	No	1st year	
Hahnemann Medical College of Philadelphia.	Philadelphia, Pa	2	2	2	No		
SCHOOLS OF DENTISTRY.							
New Orleans Dental College	New Orleans, La	1	..	1			
Baltimore College of Dental Surgery.	Baltimore, Md	1	..	1	No		
Boston Dental College	Boston, Mass	1	0	1	No		
Dental School of Harvard University.	Boston, Mass	5	0	5			
Dental College of the University of Michigan.	Ann Arbor, Mich	4	0	4	No		
Western College of Dental Surgeons.	St. Louis, Mo	1	0	1	No		
New York College of Dentistry	New York, N. Y	2	2	2	Yes		
Ohio College of Dental Surgery	Cincinnati, Ohio	1	..	1	Yes		
Pennsylvania College of Dental Surgery.	Philadelphia, Pa	2	..	2	No		
Philadelphia Dental College	Philadelphia, Pa	1	..	1			
SCHOOLS OF PHARMACY.							
California College of Pharmacy	San Francisco, Cal	1	1	1	No	In public sch'ls	
Chicago College of Pharmacy	Chicago, Ill	2	0	2	No		
Louisville College of Pharmacy	Louisville, Ky	1	..	1		Public high sch	
Maryland College of Pharmacy	Baltimore, Md	1	..	1	No	City high scho'l	
Massachusetts College of Pharmacy.	Boston, Mass	3	..	3	No	Public schools	
School of Pharmacy of the University of Michigan.	Ann Arbor, Mich	5	1	5	No	1st year	
St. Louis College of Pharmacy	St. Louis, Mo	2	1	2	No	1st year	
College of Pharmacy of the City of New York.	New York, N. Y	2	..				
Cincinnati College of Pharmacy	Cincinnati, Ohio	3	..		Yes		
Philadelphia College of Pharmacy.	Philadelphia, Pa	1	..		No	Junior	
National College of Pharmacy	Washington, D. C	2	2	2	1 does		

and physics in secondary schools, &c.—Continued.

Course of study.		Average age of pupils beginning these studies.	Approximate value of chemical and physical apparatus.	Text books used.		Instruction began.	
Chemistry.	Physics.			In chemistry.	In physics.	Chemistry.	Physics.
9	10	11	12	13	14	15	16
9, 15, 16				143, 295			
9 or 7		25	$600	124, 210, 282, 308		1860	
L 9, 17		22	1,000	127, 141, 168		1873	
E. 5 t.		23		127, 233, 307	111		
				143, 168, 183, 277, 282			
9			150	None reported			
9 or 7, 16		22		124, 143, 282, 284, 294, 308		1860	
L. 9, 16		20–23	1,000	Instruction wholly by teacher.		1877	
9 or 7		20	2,000	143, 182		1848	
L. 9		20	1,500	143		1839	
L. 9		21–22	50	168, 295		1868	
E. 5 t.				192, 229, 281, 291, 294			
E. 5 t.		22	3,000	168, 233	111	1875	
9		Over 20	100	170, 190		1877	
9		18–20	400	124, 129, 295	13	1866	
9		23	500	143		1845	
7		21 or over.	500	143, 168, 225, 238, 295		1852	
				170, 183, 188			
L. 9		19	1,000	124, 143, 210, 309		1874	
9 or 7		20	2,000	124, 143, 295	39	1860	
9		17	500	130, 143, 238, 295		1872	
7 or 8		18	1,000	143, 256, 295, 296		1841	
7		20	5,000	141, 235, 295		1847	
E. 5 t.		20		168, 193, 233, 258, 275, 276, 295, 307.	111	1868	
7		18	2,500	143, 238, 239, 256		1866	
9 or 6 t.		18	2,500	143, 238, 260, 273, 274, 295		1831	
L. 7 or 8		17	1,000	143, 235, 238, 260, 274, 295		1871	
9 or 7			1,000	143, 295		1821	
7		20	300	124, 273, 295		1873	1873

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THE SPELLING REFORM.

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CONTENTS.

APPENDIX.

LETTER.

DEPARTMENT OF THE INTERIOR,
BUREAU OF EDUCATION,
Washington, D. C., September 4, 1880.

SIR: I have the honor to invite your attention to the following statement of the progress of the reform in spelling the English language. The statement has been prepared at my request by F. A. March, LL.D., professor of the English language and of comparative philology in Lafayette College, Easton, Pa., and president of the Spelling Reform Association, a well recognized authority upon the subject.

In training the young to a correct use of good English, our teachers encounter few embarrassments greater than those arising from the anomalies of English spelling. Many of these difficulties have long been universally acknowledged, but as yet no remedy has met with general favor. Many experiments have been made: not a few attempts at change have failed; others have been conducted with great skill and learning, and have commanded increasing attention and approval. More recently some of our most eminent scholars have taken up the subject, and certain points on which they agree have received very extensive public approval.

The Home Journal, of New York City, a newspaper of social and literary importance and a supporter of the reform, published last spring a collection of opinions from a hundred noted educators, authors, and scholars. Among these, President F. A. P. Barnard, of Columbia College, New York, speaking of "our vicious system of English orthography," says that "looked at in an economical view, nothing could be more wasteful; regarded in its scientific aspect, nothing could be more absurd." The Earl of Malmesbury is quoted as being of the opinion that "no prime minister, from Lord Bute to Lord Palmerston, could pass an examination in spelling." Prof. Max. Müller, of Oxford University; President Noah Porter, of Yale College; Prof. A. P. Peabody, of Harvard University; President D. C. Gilman, of Johns Hopkins University; Dr. S. Wells Williams, the eminent Sinologue, and Prof. S. S. Haldeman, of the University of Pennsylvania, also approve of the reform, looking at it from different standpoints. Mr. Donald G. Mitchell, the distinguished author of Dream-Life and other books, regrets "the parting from old forms," but believes "in the good sense and economies of the new." The late Prof. James Hadley may also be mentioned as one of the most eminent authorities who have favored improvements in English orthography.

The disposition to apply philosophical methods to the spelling of words is also seen in the efforts to simplify the orthography of the German language. The suggestions of the late Professor von Raumer have been accepted by the educational departments of Prussia, Bavaria, and Austria, and introduced into the schools of those countries.

As authoritative information of the progress made is beyond the reach of the great body of teachers, save as supplied by this Office, I deem the publication of the accompanying paper of great importance to the teachers and school officials in correspondence with this Bureau.

Very respectfully, your obedient servant,

JOHN EATON,
Commissioner.

Hon. CARL SCHURZ,
Secretary of the Interior.

Approved, and publication ordered.

C. SCHURZ,
Secretary.

AN HISTORICAL SKETCH OF THE MOVEMENT FOR SPELLING REFORM.

THE INTERNATIONAL CONVENTION.

The present organized movement for spelling reform had its rise in our centennial year. An International Convention for the Amendment of English Orthography was held at Philadelphia from August 14 to August 17 of that year. The design of the convention, as stated in the circular by which it was called, was "to settle upon some satisfactory plan of labor for the prosecution of the work so happily begun by the American Philological Association and various other educational associations in this country and England." The convention was well attended from all sections of this country and from England; it was presided over by Prof. S. S. Haldeman, of the University of Pennsylvania, president that year of the Philological Association.

The motive power which urges the reform was set forth as follows in the opening address of Prof. F. A. March:

Thrėe yėars are spent in our primary schools in learning to rėad and spell a little. The German advançes as far in a twelvemonth. A large fraction ef the school time ef the millions is thus stolen frem ūseful studies and devoted to the most painful drudgery. Millions ef yėars are thus lest in every generation. Then it affects the intellect ef beginners. The child should have its rėason awakened by erder, proportion, fitness, law in the ebjects it is made to study. But wo to the child who attempts to ūse rėason in spelling English. It is a mark ef premise net to spell ėasily. One whose rėason is active must learn net to ūse it. The whole precess is stūpefying and perverting; it makes great numbers ef children finally and ferever hate the sight ef a book. There are reported to the takers ef our last çensus 5,500,000 illiterates in the United States. One half at lėast ef those who report themselves able to rėad, cannet rėad well enough to get much good frem it. But meral degeneraçy fellows the want ef cultivated intelligençe. Christianity cannet put forth half her strength where shė cannet ūse her presses. Republics fall to ruin when the pėople become blind and bad. Wė eught then to try to improve our spelling frem patrietic and philanthrepic motives. If thėse do net move us, it may be worth while to remember that it has been compūted that wė throw away $15,000,000 a yėar paying tėachers fer addling the brains ef our children with bad spelling, and at lėast $100,000,000 more paying printers and publishers fer sprinkling our books and papers with silent letters.

The immediate urgency of these considerations was variously enforced by many speakers, and the convention finally passed the following resolution:

Resolved, That this convention has listened with great interest to the facts presented by J. B. Towe, of Virginia, in regard to the impossibility of teaching his brother freedmen the present English spelling; and to his appeal on their behalf. And also to the facts and appeal of S. V. Blakesly, of California, in regard to and on behalf of the pagan populations amung whom he is laboring as a Christian missionary; and that we earnestly commend this matter to the attention of all who have at heart the perpetuity of our institutions and the progress of Christianity; and especially to the Bible and Tract Soçieties and Freedmen's Aid Soçieties, whose duty it is to use the press wisely for these vital ends, and that we urge the speedy publication in English of the Bible and uther good books in a reformed spelling.

The obstruction which our irregular and delusive spelling offers to etymological research, and to scientific study of our language, was also frequently enforced, and the opprobrium which it brings upon English scholars.

A large number of schemes of reform were presented to the convention; but after giving all a hearing, there seemed to be a unanimous desire to obtain definite action by the Philological Association, and a hearty disposition to accept and adopt whatever they should recommend. The members of the convention organized, however, as a Spelling Reform Association, and prepared to urge the necessity of reform, while the philologists should be deliberating as to what the reform should be.

THE AMERICAN PHILOLOGICAL ASSOCIATION.

At the annual meeting of the American Philological Association in 1874, at Hartford, the president spoke in the opening address at some length on the reform of our spelling. He said, among other things:

It is of no use to try to characterize with fitting epithets and adequate terms of objurgation the monstrous spelling of the English language.

The time lost by it is a large part of the whole school-time of the mass of men. Count the hours that each man wastes in learning to read at school, the hours which he wastes through life from the hindrançe to easy reading, the hours wasted at school in learning to spell, the hours spent through life in keeping up and perfecting this knowledge of spelling, in consulting dictionaries, a wurk that never ends, the hours that he spends in writing silent letters; and multiply this time by the number of persons who speak English, and we shall have a total of millions of years wasted by each generation. The cost of printing the silent letters of the English language is to be counted by millions of dollars for each generation. And yet literary amateurs fall in luve with these squintings and lispings. They try to defend them by pleading their advantage in the study of etymology. But a changeless orthography destroys the material for etymological study, and written records are valuable to the philologist just in proportion as they are accurate records of speech as spoken from year to year.

Next year, 1875, at Newport, the subject was resumed by the president, Hon. J. Hammond Trumbull. He said:

In the devious mazes of American linguistics it is easy to lose one's way and forget the time. Let us return homeward, to say sumething about a language in

which members ef thė Assoçiation have a more direct and selfish interest than in thė Algenkin — a language which, in spįte ef thė predictions ef Noah Webster, that a "fūtūre separation ef thė *American* tungue was neçessary," Americans still luve to call *English*.

There are indications ef incrėased interest in this subject. Thė pepūlar mįnd sėems awake, as never before, to apprėçiation ef thė difficulties, ecçentriçities, and absurdities ef thė present standard-English cacegraphy. Thė remarks ef Professor March, in his address to thė Assoçiation last yėar have been extensively cepied, and apparently mėet very general approval. Professor Whitney's discussion ef thė question, "How shall wė spell?" has helped expose thė wėakness ef thė stereotyped objections urged against referm. Legislators are beginning to look at thė subject frem thė economic peint ef view, as related to pepūlar edūcation, and are considering how much bad spelling costs thė country per annum. A bill is now before thė legislatūre ef Connecticut fer thė appeintment ef a commission to inquįre and report as to thė expėdiençy ef employing a refermed ertheqrapy in printing thė laws and journals. Thė "spelling matches" which, last winter, became epidemic, had their inflūençe, by bringing more clėarly to pepūlar apprehension thė anemalies ef thė current erthegraphy, and disposed many to admit (with Mr. A. J. Ellis) that "to spell English is thė most difficult ef hūman attainments."

Amung schelars there is little differençe ef opinion en thė main question, Is referm of thė present spelling desįrable? Thė objection, that referm would obscūre etymology, is net urged by rėal etymelogists. "Our commun spelling is eften an untrustwurthy guįde to etymology," as Professor Hadley averred; and Prof. Max Mūller's declaration that, "if our spelling fellowed thė pronunçiation ef wurds, it would in rėality bė ef greater help to thė critical stūdent ef language than thė present unçertain and unsçientific mode ef wrįting," reçėives thė nėarly ūnanimous assent ef English schelars.

Equally unfounded is thė objection that wurds when dėçently spelled would lose their "histeric interest." Thė medern erthography is, sūperlatively, unhistorical. Instead ef guįding us to, it draws us frem, thė "well ef English undefyled." The only history it can bė trusted to tėach begins with thė publication ef Jehnson's dictionary.

Thė greatest ebstacle to referm is thė want ef agrėement amung schelars as to thė best mode ef effecting it. What sėems an improvement to one is regarded by anuther as an undesįrable innovation, er, perhaps, as a new defermity. Few men are without a pet erthographical prejudiçe er two, and thė more unrėasonable thėsȩ are, thė more ebstinately they are held fast.

Perhaps thė most that can bė hoped fer, at present, is sume appreximation to general agrėement, as to thė wurds, er classes ef wurds, fer which an amended spelling may bė adepted, concurrent with that which is now in ūse. A list ef wurds "in referençe to which present ūsage in thė Unįted States er England sanctions more than one way ef spelling," is prėfixed to Webster's and Worcester's dictionaries. A similar list, prepared under judicious limitations, exhibiting sįde by sįde thė present and a refermed spelling, and an agrėement ef preminent schelars in England and America that thė ūse of ėither ferm shall bė recognįzed as allowable spelling, would go far towards ensūring thė succȩss of referm.

It is in complįançe with suggestions repėatedly made, and frem various quarters, that this subject has been breught to thė consideration ef thė Assoçiation. It is fer you to deçįde whether it is advįsable to take any action fer promoting and dįrecting thė pepūlar movement fer refermed erthegraphy.

Prof. F. A. March, of Lafayette College; Prof. S. S. Haldeman, of the University of Pennsylvania, and Prof. L. R. Packard, of Yale Col-

lege, were appointed a committee upon this part of the president's address; and on the third day of the session they reported:

It dues nat sėem desįrable to attempt such swėeping changes as to lėave thė general spėech without a standard, or to render it unintelligible to commun rėaders; but thė changes adopted in our standards of thė written spėech have lagged far behįnd those made in thė spoken language, and thė present sėems to bė a favorable tįme for a rapid reform of many of thė wurst discrepançies. Thė committee think that a considerable list of wurds may bė made, in which thė spelling may bė changed, by dropping sįlent letters and utherwįse, so as to make them better conform to thė analogies of thė language and draw them nėarer to our sister languages and to a general alphabet, and yet lėave them recognįzable by commun rėaders; and that thė publication of such a list under thė authority of this Assoçiation would do much to acçelerate thė progress of our standards and thė general reform of our spelling.

Thėy recommend that a committee bė raised, to consist of thė first president of thė Assoçiation (Prof. W. D. Whitney) and uther recognįzed representatives of our great ūniversities and of linguistic sçįençe, to whom thė whole subject bė referred, and who may prepare and print such a list of wurds if they think best, and who bė requested to report at thė next mėeting of thė Assoçiation.

A committee was accordingly appointed, consisting of Prof. W. D. Whitney and J. H. Trumbull, of Yale College; Prof. F. J. Child, of Harvard College; Prof. F. A. March, of Lafayette College, and Prof. S. S. Haldeman, of the University of Pennsylvania. At the annual meeting in 1876 the chairman presented the following report:

1. Thė true and sole offiçe of alphabetic wrįting is faithfully and intelligibly to represent spoken spėech. So-called "historical" orthography is only a conçession to thė wėakness of prejūdiçe.

2. Thė įdėal of an alphabet is that every sound should have its own unvarying sįgn, and every sįgn its own unvarying sound.

3. An alphabet intended for ūse by a vast commūnity nėed not attempt an exhaustive analysis of thė elements of utterançe, and a representation of thė nįçest varįeties of articūlation; it may well lėave room for thė unavoidable play of individūal and local pronunçiation.

4. An įdėal alphabet would sėek to adopt for its characters forms which should suggest thė sounds signifįed, and of which thė resemblançes should in sume measūre represent thė similarities of thė sounds. But for general practical ūse there is no advantage in a system which aims to depict in detail thė physical proçesses of utterançe.

5. No language has ever had, or is lįkely to have, a perfect alphabet; and in changing and amending thė mode of wrįting of a language already long written, regard must neçessarily bė had to what is practically possible quįte as much as to what is inhėrently desįrable.

6. To prepare thė way for such a change, thė first step is to break down, by thė combįned influençe of enlįghtened scholars and of practical edūcators, thė immense and stubborn prejūdiçe which regards thė established modes of spelling almost as constitūting thė language, as having a sacred character, as in themselves preferable to uthers. All agitation and all definite proposals of reform are to bė welcumed so far as they wurk in this direction.

7. An altered orthography will bė unavoidably offensive to those who are first called upon to ūse it; but any sensible and consistent new system will rapidly win thė hearty preferençe of thė mass of wrįters.

8. Thė Roman alphabet is so wịdely and firmly established in ūse amung thė lėading civilịzed nations that it cannot bė displaçed; in adapting it to improved ūse for English, thė efforts of scholars should bė directed towards its ūse with ūniformity and in conformity with uther nations.

The report was accepted, and, on motion of Professor Whitney, the committee was continued another year, with Prof. F. A. March as chairman. This report was widely publisht and commented on and assented to, but there was a loud call for more: a definite application of these principles to English spelling was demanded. The International Spelling Reform Convention embodied this demand in their action. In 1877 the annual meeting was held at Baltimore. President Haldeman devoted a large part of his address to this subject. The committee reported as follows:

Thė attempt to prepare an English alphabet according to thė prinçiples laid down in thė report of last yėar brings out thė following facts:

1. There are eightėen Roman letters which commonly represent in English nėarly thė same elementary sounds which they represented in Latin: *a* (*father*), *b*, *c*, (*k*, *q*), *d*, *e* (*met*), *f*, *g* (*go*), *h*, *i* (pick), *l*, *m*, *n*, *o* (go), *p*, *r*, *s* (*so*), *t*, *u* (*full*).

2. Thė consonant sounds represented in Latin by *i* and *u* are now represented by *y* and *w* and thė sonants corresponding to *f* and *s* are now represented by *v* and *z*.

3. There are thrėe short vowels unknown to thė early Romans which are without proper representatives in English, those in *fat*, *not*, *but*.

4. There are fịve elementary consonants represented by dịgraphs: *th* (*thin*), *th*=*dh* (*thine*, *then*), *sh* (*she*), *zh* (*azure*), *ng* (*sing*); to which may bė added *ch* (*church*), *g* (*j*).

It sėems best to follow thė Latin and uther languages written in Roman letters in thė ūse of a single sịgn for a short vowel and its long, distinguishing them when great exactness is requịred by a dịacritical mark.

Thė alphabet would then have thirty-two letters.

Twenty-two of thėse have their commun form and power as descrịbed abuve in statements 1 and 2.

Thė thrėe vowels in *fat*, *not*, *but* nėed new letters. Without laying any stress on thė exact form, it is recommended to try sume modification of *a*, *o*, *u*, such as ɑ, ɵ, ʋ.

For thė consonants now represented by dịgraphs new letters would bė deșịrable, but no particūlar forms are now recommended. Thė following are mentioned:

đ, ꝺ (then); þ, ƀ (thin); ʃ, ɦ (sh); ʒ (zh); ŋ (ng); ç (ch).

Thė ūse of thėse letters with only thėse powers and thė dropping of sịlent letters will so change thė look of large numbers of wurds that they will not bė recognịzed at sịght. It sėems neçessary therefore that there should bė a transition pėriod, and for that thė following suggestions are made:

1. Transition characters may bė ūsed resembling, if possible, two letters:

For	*a* in *fate*,	ɑ	may bė ūsed in plaçe of	ē.
"	*e* " *mete*,	ė	" " "	ī.
"	*i* " *fine*,	ị	" " "	ai.
"	*u* " *pure*,	ū or ɥ	" " "	iu.
"	*s* " *as*,	ȥ	" " "	z.
"	*g* " *gem*,	g	" " "	j.
"	*c* " *cent*,	ç	" " "	s.

2. Thė dịgraphs now representing single consonants may bė named and utherwịse trėated as single letters.

3. New letters can bė ėasiest introdūçed by ūsing them only for thė old letters which they resemble in form.

4. Long wurds bear changes best and vowels are more easily changed than consonants, which project more abuve and below the line. Dropping final silent *e* is the easiest change.

On motion the report was adopted, no one dissenting.

This action, it will be seen, gives a Roman alphabet for English use such as the scholars hope to see finally adopted, and also attempts to furnish guidance through the transition period from the present to the future spelling. Types were immediately cut for the new letters, and papers are printed in the transactions of the association in amended spelling with new types if the authors wish. There seemed still to be needed the entering wedge of a few particular amended words.

In 1878, at Saratoga, at the annual meeting, the committee further reported:

In accordance with the plan of preparing a list of wurds for which an amended spelling may be adopted concurrent with that now in use, as suggested by President J. Hammond Trumbull at the session of 1875 and favorably reported upon by the committee of that session, the committee now present the following wurds as the beginning of such list, and recommend them for immediate use: *Ar, catalog, definit, gard, giv, hav, infinit, liv, tho, thru, wisht.*

This movement in the Philological Association was accompanied with the reading of papers on special points of phonetic reform and called out no opposition.

THE SPELLING REFORM ASSOCIATION.

After the organization of the Spelling Reform Association in August, 1876, and while waiting for the action of the philologists, its members set themselves to produce and concentrate dissatisfaction with the old spelling. Quarterly meetings were held at Philadelphia, Boston, and New York. The membership was largely increased. A bulletin was issued. The members wrote articles for newspapers and magazines and visited and addrest teachers' associations and other organizations. The result of these labors will be set forth more in detail when we speak of teachers, the press, and the State.

The annual meeting in 1877 was held at Baltimore immediately after the adjournment of the Philological Association. Profs. F. A. March, S. S. Haldeman, and W. D. Whitney had been appointed a committee on new spellings, and persons having new schemes had been requested to submit them to the consideration of the committee. Scores of new alphabets and sets of rules, accompanied often with voluminous exposition, were sent in. The committee now made a final report upon them, which recited the action of the Philological Association and reported for general use and for the publications of the Spelling Reform Association the alphabet therein set forth; and recommend the attempt to bring it into immediate use in the manner set forth in the final suggestions of the philological report. This report was adopted, no one dissenting.

The committee of publication proceeded to procure types and script plates for the new letters and to make the alphabet known to the public.

THE ALPHABET.

All vowels ſhould bė named by their sounds: c ſhould bė called kė, ç sė, g gė, ɡ jė, h hė, s ez, w wė, y yė. Dhe digraph censonants ſhould net bė spoken ef as two letters, but ꝡh ſhould bė called eꝡh, ſh iſh, ꝧ eꝧ, dh = th thė, zh zhė, ng ing.

Vauels.

Shert.		Leng.	
I i,	it.	E ė = ɪ,	hė, poliç.
E e,	met.	Ɑ a = ē,	potato, thēy, fare.
A a,	at.	ā,	fāre (in Ɑmerica).
Ɑ ɑ,	ɑsk (sė dicſhunaris).	ɑ̄,	fɑ̄r.
Θ e,	net, what.	ē,	nēr, wall.
O o,	wholly (in Nū Ingland).	ō,	nō, hōly.
U ʋ,	bʋt.	ʋ̄,	bʋ̄rn.
U u,	full.	ū,	rūle, fool, move.

Difthengs: I ɨ = ɑi, find, fɑind. ƟU ɑu, hɑus = house. ƟI ei, eil. Ū ū = iu, ūnit, mūsic, miusic.

Censonants.

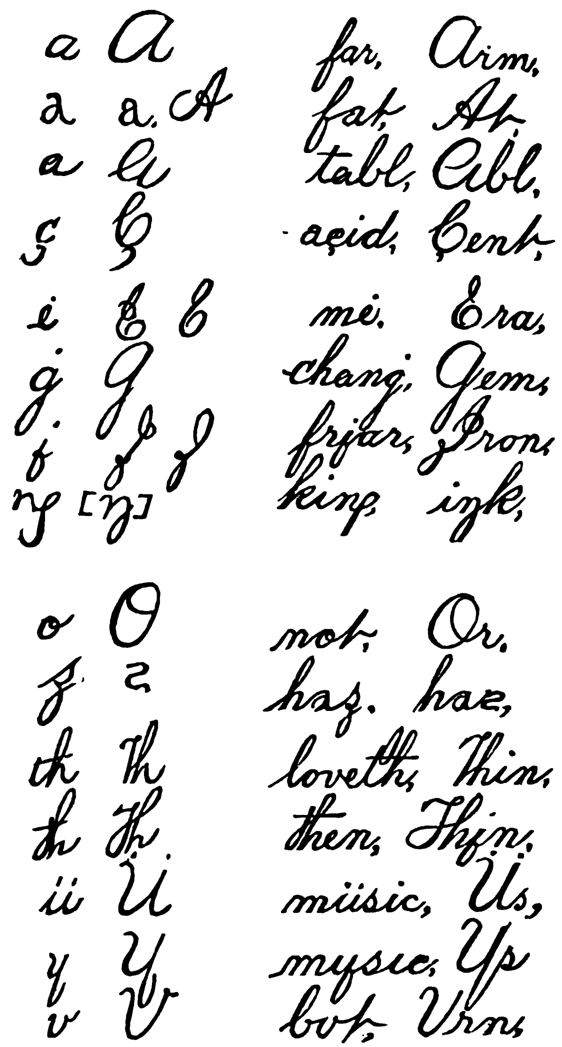
	Surd.				Sonant.
P	p,	pet.	B	b,	bet.
T	t,	tep.	D	d,	did.
CH	ꝡh,	ꝡhʋrꝡh.	J	j, er ɡ,	jet, gem.
C	c, er k, q,	cake, cwit (quit).	G	g,	get.
F	f,	fit, filesofer.	V	v,	vat.
TH	ꝧ,	ꝧin, piꝧy.	DH	th,	Dhė, thė.
S	s, er ç,	so, çent.	Z	z, er s,	zone, is.
SH	ſh,	ſhė.	ZH	zh,	fūzhʋn.
WH	wh,	whiꝡh (in Ingland).	W	w,	wė.
H	h,	hė.			

L l, lo. R r, rat. Y y, yė. M m, mė. N n, no. NG ng er ŋ, king, iŋk.

Silabic: l, nobl, nobls; m, spasm, spasms; n, tokn, tokns.

Naſhuns hwiꝡh ūs thė Roman alfabet mak thė sam leter stand fer ɑ ſhert vauel and its leng, distiŋgwiſhing thė tū hwen nėdful bɨ ɑ dɨacritical mark. It is intended tu ūs thė nū alfabet in this wa. In pepūlar print onli thė vauels givn as ſhert, and ė and a, nėd bė ūsed.

SCRIPT FORMS OF NEW AND TRANSITION LETTERS.



Having settled the alphabet, so that it is clearly seen what should be aimed at, it has been the policy of the Association to encourage all sorts of changes which tend towards it. Many amendments are plainly possible without the use of new types. The dropping of silent letters affords the most obvious examples. The Association has accordingly recommended various special rules for spelling without new types.

The words *hav*, *giv*, and *liv* are its entering wedge. It gives them a special indorsement such as the Philological Association gives to the eleven words *ar*, *catalog*, *definit*, *gard*, *giv*, *hav*, *infinit*, *liv*, *tho*, *thru*, *wisht*.

The following have become widely known as "The five new rules:"

(1) Omit *a* from thė dịgraf *ea* when pronounçt as *e* short, as in *hed*, *helth*, etç. (2) Omit sịlent fịnal *e* after a short vowel, as in *hav*, *giv*, etç. (3) Wrịte *f* for *ph* in such wurds as *alfabet*, *fantom*, etç. (4) When a wurd ends with a dubl leter, omit thė last, as in *shal*, *clif*, *eg*, etç. (5) Change *ed* fịnal to *t* wher it has thė sound of *t*, as in *lasht*, *imprest*, etç.

The Association has also printed a more extended

PROPER ORDER OF CHANGES.

NEW LETTERS.—For rėders thė introduction of nėw leters is thė ėasiest chang. Printers do thė wurk for them. It is advịsd to ūs nėw leters at first only for thė old leters which they resembl in form. It is not neçesary to ūs them all. Printers ar urgd to ūs one or two, if they think mor ar dangerus. Most important ar e and u, then a. Nėw g for g with thė sound of j may bė ūsd without disturbing thė most fastidius; so may ç and ė.

DROPPING LETTERS.—Wrịting is a diferent mater from rėding. Old muscūlar habits interfėr with nėw leters or any uther changes in wrịting. Children wil lern thė nėw as redily as thė old; but for grown persons, thė ėasiest changes ar thė droping of sịlent leters. Vowels ar ėasiest to drop, and amung vowels, *e*. When sịlent after a short vowel it is both wast and blunder; *hav* spels thė wurd intended; *have* shud rịm with *gave*, *slave*, *knave*, etç.; *genuin* spels thė wurd, *genuine* is a vulgar coruption. Long wurds bear changes beter than short wurds. So that wė hav thė folowing order for droping sịlent fịnal *e* and uther sịlent leters:

I. FINAL SILENT E.

1. With short prėçėding vowel. (*a*) In long wurds: practicabl, acçessibl, imbeçil, periwinkl, mediçin, trėatis, recompens, hypocrit, infinit, indicativ. Many hundreds of wurds belong to this clas, in great part lerned terms from Grėek or Latin, and comun to many languages. To scholars they look mor natūral and scholarly, as most languages wrịt them, without the fịnal *e*. (*b*) In short wurds: hav, liv, giv.

2. With long vowel prėcėding. (*a*) Thė long sound represented by two leters in thė old speling: frontispieç, pėaç, veiç, relėas, believ, percėiv, prais, peis, etc. (*b*) Thė long sound reprėsented by a singl leter in old speling: imbịb, glob, popūlaç, suffịç, undertak, provok, confiscat, constitūt, persecūt, and hundreds mor.

Drop it also in plurals and uther inflexions: represėntativs, givs, livd, compeld, etc.

II. T FOR ED.

Anuther ėsy chang comun in old English, and agen becuming so, is to wrịt *t* for *ed*, when it is so pronounçt: kist, wurshipt, lasht, imprest, approcht, etc.

III. OTHER LETTERS.

1. Omit fịnal *ue* in catalog, colėag, harang, etc.

2. Omit *a* from thė dịgraf *ea* when pronounçt as *e* short: hed, heven, helth, welth, zelus, etc.

3. Omit *gh* when sịlent, and suply its plaç with *f* when pronounçt as *f*: dauter, slauter, tho, altho, thru, enuf, ruf, etc.

4. Wrịt *f* for *ph* in alfabet, fantom, camfor, filosofy, etc.

5. Wrịt *k* or *c* for *ch* in all wurds in which *ch* is pronounçt as *k*: arcitect, monarc, comistry, caracter, cronicl, etc.

6. Omit *b*, *c*, *d*, *f*, *g*, *h*, *k*, *l*, *m*, *n*, *p*, *r*, *s*, *t*, *w*, *z*, *ch*, *rh*, and *th* when sịlent, as in thė folowing exampls:

b in eb, det, lam, lim, etc.

c in abses, absind, acquies, coales, efferves, sent (scent), septer, simitar, sịon (scion), vitls, etc.

d in Wensday, ad, od, etc.

f in buf, bluf, clif, muf, scof, stif, etc.

ciation of Pennsylvania setting forth the action of the philologists. The response of the professors of normal schools and other leaders was that they had supposed that the present spelling was retained to please the philologists; if they did not want it, certainly nobody else did.

The following resolution was adopted without dissent:

Rezolvd, That wē hal with plezhur thē contemplated chang in thē method ov speling, and that wē wil most hartily cooperat with and ad any fēsibl plans for bringing about so dezirabl a rezult; olso, that a comit'e ov fiv bē apointed to confer with that rezd by thē Philological Convention for a lik purpos, and that, if dēmd advizabl, sed comit'e bē instructed to memorializ thē legislatūr to ad thē wurk by legal enactments.

The committee consisted of Prof. F. A. March, of Lafayette College; Hon. J. P. Wickersham, State superintendent of education; and (from State normal schools) E. B. Fairfield, A. N. Raub, and W. W. Woodruff.

Similar action followed in the State Teachers' Convention of New Jersey.

In July, 1877, the State Teachers' Association of New York appointed a committee to ask the legislature of that State to create a commission to inquire into the reform, and report how far it may be desirable to adopt amended spelling in the public documents and direct its use in the public schools.

The Ohio State Teachers' Association also took action in favor of the reform.

In 1878 the following memorial was prepared:

To the honorable the Senate and House of Representatives of the United States in Congress assembled:

This memorial of the undersigned, members of the American Philological Association and others, respectfully represents that it is currently stated by leading educators that the irregular spelling of the English language causes a loss of two years of the school time of each child and is a main cause of the alarming illiteracy of our people; that it involves an expense of hundreds of millions of dollars annually for teachers and for writing and printing superfluous letters, and that it is an obstacle in many other ways to the progress of education among those speaking the English language, and to the spread of the language among other nations.

It further represents that leading educators, among whom are many teachers of much practical experience, and associations of learned scholars declare it possible to reform our spelling and have proposed schemes of reform.

The prayer of your memorialists therefore is that your honorable body may see fit to appoint a commission to examine and report how far such a reform is desirable, and what amendments in orthography, if any, may be wisely introduced into the public documents and the schools of the District of Columbia and accepted in examinations for the civil service, and whether it is expedient to move the government of Great Britain to unite in constituting a joint committee to consider such amendments.

And your memorialists, as in duty bound, will ever pray, etc.

It was headed by the members of the spelling reform committee: F. A. March, chairman, Lafayette College; W. D. Whitney, Yale College; J. Hammond Trumbull, Yale College; F. J. Child, Harvard College; S. S. Haldeman, University of Pennsylvania.

Then follow the ex presidents of the American Philological Association: Howard Crosby, president of the University of New York; W. W. Goodwin, Harvard College; A. Harkness, Brown University; J. B. Sewall, Bowdoin College; and C. H. Toy, president of the association.

It is also signed by philologists and professors in the following universities and colleges: Bowdoin College, Me.; Dartmouth College, N. H.; Amherst College, Mass.; Andover Theological Seminary, Mass.; Harvard College, Mass.; Phillips Academy, Mass.; Williams College, Mass.; Brown University, R. I.; University Grammar School, R. I.; Trinity College, Conn.; Yale College, Conn.; Hopkins Grammar School, Conn.; Cornell University, N. Y.; Rochester Theological Seminary, N. Y.; University of New York, N. Y.; Princeton College, N. J.; Franklin and Marshall College, Pa.; Lafayette College, Pa.; University of Pennsylvania, Pa.; Haverford College, Pa.; Washington and Jefferson College, Pa.; Johns Hopkins University, Md.; St. John's College, Md.; Hiram College, Ohio; Marietta College, Ohio; State University, Ohio; Wesleyan University, Ohio; Wooster University, Ohio; Illinois Industrial University, Ill.; Northwestern University, Ill.; Shurtleff College, Ill.; Adrian College, Mich.; Michigan University, Mich.; Iowa College, Iowa; Cornell College, Iowa; Lawrence University, Wis.; Central College, Mo.; Baptist Theological Seminary, Ky.; Logan Female Institute, Ky.; Vanderbilt University, Tenn.; East Tennessee University, Tenn.; University of Virginia, Va.; University of Alabama, Ala.; University of Mississippi, Miss.; State Agricultural College, Oreg.; Agricultural and Mechanical College, Tex.; the United States Naval Observatory, Washington, &c.—about fifty leading colleges.

These colleges, it should be noticed, are those interested in the Philological Association. The memorial has not been sent out to colleges in general.

In many colleges the professors interested themselves to obtain other signatures, and the names of the most active and efficient presidents of colleges—like Dr. Crosby, of New York; Chamberlain, of Bowdoin; Chadbourne, of Williams—appear on the roll.

The University of Mississippi appointed a committee to consider the propriety of uniting in the memorial, the chairman of which was Prof. J. D. Johnson, LL. D., well known as one of the foremost Anglo-Saxon scholars in the South. They made an able report in favor of action, which has been printed.

But the Industrial University of Illinois seems to be the banner institution. It is reported that the whole of its faculty and almost all of its 300 students are in favor of the reform, and have organized as a spelling reform association for immediate amendment of their own spelling and general missionary work.

The memorial was brought before the American Institute of Instruction, which resolved to unite in it. Ten thousand teachers were said to be at the meeting.

The department of public instruction of the city of Chicago took up the matter, and its board of education unanimously adopted a resolution —

That thė secretary of this board correspond with thė prinçipal school boards and edŭcational assoçiations of thė country with a view to cooperation in thė reform of English spelling.

A circular letter was accordingly issued in December, 1878, asking such boards to unite in the memorial to Congress, and it has received many favorable responses.

During the Christmas holidays in 1878 a large part of the teachers and school officers, and, indeed, of all persons interested in education in this country, had their attention turned to the spelling reform. The State Teachers' Associations met in many States, and in those in which they did not there were very general meetings of county institutes or other smaller associations. At these meetings this year almost everywhere papers were read and discussions had on this reform. These were reported in educational and other papers, and in many places followed by other articles on the subject.

The Massachusetts Teachers' Association met at Worcester, December 26. J. A. Allen read a paper on "Spelling reform," which provokt a lively discussion and led to the appointment of a committee to coöperate with the American Philological Association in memorializing Congress for the establishment of a commission to investigate the orthography of the English language and report upon reforms in it. The report was adopted, and Messrs. D. B. Hagar, Salem; N. T. Allen, Newton; B. F. Tweed, Boston; A. P. Stone, Springfield; A. G. Boyden, Bridgewater, were appointed.

The Illinois State Teachers' Association met at Springfield, December 26. Dr. Willard, of the Chicago High School, read a paper on "How to systematize English orthography." A discussion followed, and a committee on spelling reform was appointed, to report next year.

The Iowa State Teachers' Association passed the following:

Rezolvd, That wė hartily approve thė action of thė Philological Assoçiation in asking of Congres a commission to examin into thė desirability of reform in English spelling.

The Michigan State Teachers' Association had the spelling reform brought before them by E. O. Vaile, editor of the Educational Weekly, Chicago.

In Indiana and Wisconsin it was also up. It is said in a report to the legislature of Wisconsin on the subject that "nearly 400 residents of Wisconsin, officers and professors in our colleges and teachers in our public schools, have united in a memorial to Congress asking the appointment of a national committee."

The State Teachers' Association of Missouri not only passed resolutions in favor of reform, but is to have its proceedings printed in amended spelling.

In Maryland and Virginia also favorable action has been taken. The Educational Association of Virginia is a very strong body. It has among its active members many of the eminent professors of the University of Virginia and its other literary institutions. A committee on the reform was appointed in 1878. It made an elaborate report at the annual meeting in July, 1879, and, in accordance with the recommendations of the report and after an interesting discussion, the following resolutions were adopted:

Rezolvd, (1) That a cemiti bė apeinted with instrucshuns tu request thė Virginia representativs in Congres tu ūs ther influenç tu secūr favorabl acshun en thė memorial in behaf ev speling reform tu bė presented tu that bodi, and elso tu bring thė mater tu thė atenshun ev thė Virginia legislatūr and secūr such acshun as ma sėm tu them advizabl.

(2) That a permanent cemiti en speling reform, censisting ov thrė, bė apeinted.

As a specimen of the action of the county institutes we give the following:

Rezolvd, That wė (thė tėchers of thė Schuylkill County Institūte, Pa.) enders thė last anūal apėal of thė American Philological Assoçiation to tėchers, editors, and thė inteligent public to mak a begining in thė reform of droping thė ūsles *e* in thė wurds *have*, *give*, and *live*.

The Northampton County Institute, Pennsylvania, passed in substance the resolution recommended in the Chicago circular in favor of requesting our legislatures, State and national, to appoint commissions to investigate and report what can be done to simplify our spelling.

STATE LEGISLATION.

The conservative old State of Connecticut led the way in legislation on this subject. In the session of 1875 the following joint resolution passed both houses without dissent:

Rezolvd by this assembly, That thė guvernor bė, and hė hėrby is, authorized tu apoint a comishun, consisting of six competent persons, who shall examin as tu thė propriety of adopting an amended orthografy of thė public docūments hėrafter tu bė printed, and how far such amended orthografy may with propriety bė adopted, and report therupon tu thė next seshun of thė general asembly; that such comishun shal reçėv no compensashun for its serviçes. Apprūvd July 20th, 1875.

The governor appointed Senator W. W. Fowler, by whom the resotion was offered; Profs. W. D. Whitney and J. H. Trumbull, of Yale College; Hon. B. G. Northrop, secretary of the board of education; and Professors Hart, of Trinity College, and Van Benshoten, of Wesleyan University. This commission was continued by the legislature in the hope that concurrent action might be taken by other States.

At the same session of the legislature of Pennsylvania a similar joint resolution was passing without dissent, when it was notiçt too late for amendment that it must have the form of a bill. It was passed in the session of 1877-'78, after some good remarks by Senators Fisher and Allen.

At the same session, 1877-'78, the legislature of Wisconsin appointed W. C. Whitford, superintendent of public instruction, with four others, a commission on the subject. They made a report in January, 1879, which was prepared by Senator George H. Paul, of Milwaukee. It is a comprehensive and impressive argument in favor of the reform and of State action to promote it. It proposes that the superintendent of public instruction be authorized to supply the schools of the State with a dictionary embodying an amended orthography in connection with the present approved orthography.

The reform has also been brought before the legislatures of Iowa and Massachusetts, but action has not been taken upon it.

The memorial to Congress has been mentioned. Hon. A. H. Stephens, of Georgia, who is warmly interested in the reform, has taken charge of it. To this the reformers look for a joint commission of the English speaking countries, who may give authority to amendments, so far as that is possible. April 27, 1880, Mr. Ballou, of Rhode Island, of the House Committee on Education and Labor, reported

A BILL to constitute a commission to report on the amendment of the orthography of public documents.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That a commission is hereby constituted, to consist of seven commissioners to be appointed by the President, who shall examine the orthography used in the public documents and in the public schools of the District of Columbia, and inquire how much its defects increase the cost of the public printing and how far they are an impediment to the acquisition of the English language and to education, and inquire what amendments in orthography, if any, may be easily introduced into the public documents and the schools of the District of Columbia and accepted in examinations for the civil service, and whether it is expedient to move the Government of Great Britain to unite in constituting a joint commission to consider such amendments; and the commission shall report to Congress at its next session.

The committee reported in favor of the bill and exprest confidence that it will pass when it shall be reacht.

THE PRESS. DISCUSSION.

The educational journals and the organs of the craft have been specially interested. The Educational Weekly of Chicago and the New-England Journal of Education have had spelling reform departments. Communications and other articles have been frequent in many journals, in The New York Times, for example, The Chicago Tribune, and The St. Louis Republican, and in The Electrotyper, The Type Founder, The Quadrat, The Electrotype Journal, and the like.

More elaborate articles have been publisht in the Galaxy, the Atlantic, The Independent, Scribner's Monthly, the Princeton Review, the Athenæum, the Academy, The Fortnightly Review; in the proceedings of the Spelling Reform Association, the Philological Association, the American Institute of Instruction, the National Educational Association, and in books like Max Müller's Chips from a German

Workshop, Whitney's Oriental and Linguistic Studies, Hadley's Philological and Critical Essays, and Ellis's Works. Two important new books have been wholly devoted to phonetics and spelling reform: A Handbook of Phonetics, by Henry Sweet, president of the Philological Society of England, and Spelling Reform from an Educational Point of View, by Hon. J. H. Gladstone; and other and bigger books have been publisht on the subject. Prof. J. L. Johnson, of the University of Mississippi, and Prof. L. H. Carpenter, of the University of Wisconsin, leading Anglo-Saxon scholars, have publisht in favor of reform. So has Prof. Edward North, of Hamilton College.

Steiger's Year Book of Education gives a full account of spelling reform in the article "Orthography."

The subject has been discust at some of the conventions of the Press Associations, and has called out eloquent speeches and admirable resolutions. The following were unanimously adopted by the Missouri Press Association at Sedalia, May, 1880:

> Hwaraz thė irregyularitiz ov Iŋglish erthografi ar a grat obstacl to thė progres ov thė pėpl; and
>
> Hwaraz silent leterz alon ad abaut 25 pur cent. tu thė cost ov ol raiting and printing; and
>
> Hwaraz editorz, statsmen, scolarz, tėcherz, and filanthropists thruaut thė Iŋglish-spėkiŋ world ar makiŋ urnest eforts tu amend and simplifai aur speliŋ: Tharfor,
>
> Bė it rezolvd bai thė Misuri editorz in convenshun asembld, That (1) wė hartili simpathaiz with thė urnest eforts hwich ar bėing put forth tu simplifai Iŋglish erthografi; (2) wė wil ad and encurej wun anuther tu begin and mak such grajual chanjez in speliŋ az ar recomended bai thė American Filolejical Asoshiashun and thė Speliŋ Reform Asoshiashun.

PRINTING WITH NEW TYPES.

It has been mentioned that the Philological Association and the Spelling Reform Association had types cut for the new letters of the alphabet in 1877 and have used them in their publications. In the month of August, 1877, at Chicago, Ill., the Adams, Blackmer & Lyon Publishing Company, O. C. Blackmer, president, began to introduce the alphabet of the Spelling Reform Association into their widely circulated periodical The Little Folks. The letters were introduced gradually in successive months. In 1878 it announced that it contained all the new letters, and claimed that they embarrass no one, but assist in pronunciation.

Prof. F. A. March, president of the Spelling Reform Association, has prepared an A B C book with instructions to teachers in the best methods of teaching the beginnings of reading.

Mr. T. R. Vickroy, director for the Southwest, has prepared a "Reading Book" in full phonetic type and spelling. He also issued (in 1879) the first number of a paper called the Fonetic Teacher printed with the same type. The Missouri State Teachers' Association has directed

the volume of its "Proceedings" for 1879 to be printed in the same alphabet. The minutes and papers of the spelling reform department of the National Educational Association are also printed in it. Articles have appeared in it in the New-England Journal of Education and The Independent, and specimens in many newspapers and periodicals. Dr. Leigh's school books are well known and widely used. The influence in favor of new types exerted by the publications of Pitman, Parkhurst, and Longley may also be mentioned. Pitman's Journal is a weekly, with a circulation of some 12,000 copies, publisht at Bath, England. H. M. Parkhurst publishes "The Plowshar" in New York. It has reacht its thirty-third year. Elias Longley, Cincinnati, is a veteran publisher of phonetic school books, charts, and other useful works. A large number of sporadic issues in types invented by enterprising Americans diversify the field of view.

Printing in pure phonetic spelling or with new types seems as yet to be missionary work. It costs a good deal of money, and the returns are mainly sentimental. It is, however, a prime necessity, in order to keep the spelling to be aimed at constantly in view and to guide all partial amendments. It also serves as a key alphabet in pronouncing dictionaries and other works, and as an introductory alphabet in A B C books.

AMENDED SPELLING WITH OLD TYPES.

The rules for dropping silent letters given on pp. 14–16, which can be used without new types and without obscuring the words, have found special favor with the printers and they have been used more or less in many of the organs of the craft. The Electrotyper, of Chicago, has adopted the eleven words, and it says further:

"This movement, to which The Electrotyper has givn adhesion and which it is endevoring to promote, is gaining strength daily. Our cotemporaries of The Type Founder hav publisht a carefully writn articl upon the subject, which, by the way, has been issued in pamflet form, as one of the bulletins of the Spelling Reform Association; The Electrotype Journal warmly advocates the reform, and will hereafter conform to the elevn amended spelings recommended by the American Philological Association; The Chicago Specimen publishes the emendations and says that they ought to be adopted at once; The American Newspaper Reporter favors the reform and has publisht several articls advocating it; The Quadrat, Pittsburg, favors the change and may ultimately adopt it; and few thoughtful printers so far as we can lern hav aught to say against the adoption of the emendations recommended."

A number of organs of various social reforms have adopted some of these words.

The Library Journal is doing a good work in the same way.

Scientific specialists are helping by amending technical terms.

C. A. Cutter, the librarian of the Boston Athenæum and the eminent

author of the Rules for a Dictionary Catalogue, publisht by the United States, put at the head of the bibliography in the Library Journal this note:

"The American Philological Association, the only body in the country which can be said to be of any authority in the matter of language, has published a list of ten [eleven] words in which it recommends an improved spelling. With the greater part of the list librarians have no special concern; but with regard to 'catalog' I feel that we are called upon to decide whether we will slavishly follow the objectionable orthography of the past or will make an effort, at a time when there is every chance of its being successful, to effect some improvement. In this case the responsibility lies upon catalogers. The proper persons to introduce new forms of technical words are those artisans who have most to do with them. I shall, therefore, in the following notes (except when quoting) omit the superfluous French *ue*. I am well aware that the unwonted appearance of the word will be distasteful for a time to many readers, including myself; but the advantages of the shorter form are enough to compensate for the temporary annoyance. To bibliographers, who are accustomed to the German 'Katalog,' the effort to get used to 'catalog' should hardly be perceptible."

Since that time he has used this spelling entirely. Many other librarians have adopted and use it in their articles and correspondence. The editor of the Journal finds that this influence has spread so fast that he receives more spellings "catalog" than with the *ue*. The president of the American Library Association having doubts of the wisdom of the change, inquiries were sent to a number of leading librarians asking their opinion. The answers were so encouraging that Mr. Cutter now proposes to adopt the spelling "bibliografi."

The great newspapers, although so many of them were ready to write editorials in favor of reform and admit correspondence occasionally in amended spelling, were naturally slow to take the plunge. It was on the 2d day of September, 1879, that the Chicago Daily Tribune first appeared in amended spelling throughout. Hon. Joseph Medill, its editor, prepared a list of twelve specifications according to which it is printed.

The Home Journal, of New York, on the 17th of September, began to appear printed according to the following rules:

1. Drop *ue* at the end of words like dialogue, catalogue, where the preceding vowel is short. Thus spell demagog, pedagog, epilog, synagog, etc. Change tongue for tung. When the preceding vowel is long, as in prorogue, vogue, disembogue, rogue, retain final letters as at present.

2. Drop final *e* in such words as definite, infinite, favorite, where the preceding vowel is short. Thus spell opposit, preterit, hypocrit, requisit, etc. When the preceding vowel is long, as in polite, finite, invite, unite, etc., retain present form unchanged.

3. Drop final *te* in words like quartette, coquette, cigarette. Thus spell cigaret, roset, epaulet, vedet, gazet, etc.

4. Drop final *me* in words like programme. Thus spell program, oriflam, gram, etc.

5. Change *ph* for *f* in words like phantom, telegraph, phase. Thus spell alfabet, paragraf, filosofy, fonetic, fotograf, etc.

P. S.—No change in proper names.

Mr. S. N. D. North, of the Utica Herald, who presented a paper on the duties of journalists at the July meeting of the Spelling Reform Association, 1879, is said to be at the head of a league of newspapers who are planning joint adoption of still more vigorous amendments. Enthusiastic reformers are looking for a flood.

The new edition of Worcester's dictionary (1881), that most conservative of authorities, gives a large number of amended spellings. Thus *iland* is given in its proper place, and described as the earlier and correct spelling of *island;* and under *island* we find the same statement repeated, with the information that the *s* is ignorantly inserted through confusing it with *isle*, a French word from Latin *insula*. *Rime* is given in its proper place as the correct spelling of *rhyme*, and it is explained that *rhyme* is a modern blunder started by the notion that it is a Greek word like *rhythm*. *Ake* also is restored and *ache* turned over to the Greeklings. So *sithe*, which has been disguised as *scythe*, our Worcester thinks, from an impression that it was from Latin *scindo*. Milton's *sovran* is down as the true spelling of *sovereign*, an outgrowth of the idle fancy that the word was compounded with *reign*. We are informed that *coud* is the older and better form of *could;* the *l* is an "excrescence" due to the influence of *would* and *should*. The *Tatars* also recover here from the French king's pun by which they were made fiends of *Tartarus;* and so *glamour*, and *whole*, and *shame-faced*, and other like etymological blunders are branded as they deserve.

SPELLING REFORM IN ENGLAND.

The progress of the reform in England has been very much like that in America. In 1876 the National Union of Elementary Teachers, representing some 10,000 teachers in England and Wales, passed almost unanimously a resolution in favor of a royal commission to inquire into the subject of English spelling with a view to reforming and simplifying it. The school board for London took up the matter and issued a circular asking others to unite in an address to the Education Department in favor of it. The Liverpool and Bradford boards had acted before, and more than a hundred other boards returned favorable replies. On Tuesday, May 29, 1877, a conference was held in London, at which Rev. A. H. Sayce, professor of philology, Oxford, presided, and in which the president of the Philological Society, H. Sweet, esq., and Vice President J. H. Murray, LL. D., and ex presidents took part, as well as numerous dignitaries of church and state, leading school-

masters, and eminent reformers, including Mr. I. Pitman and Mr. Ellis. They spent a day and evening in harmonious discussion and in listening to short addresses, and adopted vigorous resolutions, which they appointed a committee to present to the Department of Education. The convention was a great success and called forth serious articles in The London Times, followed of course, when not preceded, by articles in the whole periodical press of Great Britain. The deputations waited on the lord president of the council, January 18, 1878. Addresses were made by Mr. Gladstone, Dr. R. Morris, Dr. Angus, Mr. Rathbone, M. P., Mr. Richards, M. P., and Mr. A. J. Ellis, F. R. S. The lord president, the Duke of Richmond and Gordon, in his reply, spoke very emphatically of the importance of the subject. He said:

It is ev such vast impertanç and so larg extent that it wud net bė delt with in eni satisfactori wa uther than bį thė Crown's bėing advįsd tu ishu a cemishun tu inquįr intu thė mater.

The main point urged is the relief of the people and the removal of illiteracy. The bulk of the children in the government schools pass through without learning to read and spell tolerably. It is fully recognized that the trouble lies in the irregular and unreasonable spelling of the language. Says Prof. Max Müller:

Thė questyon, then, that wil hav tu bė anserd sūner or later is this: "Can this unsistematic sistem ev speling English bė alaud tu go en ferever?" Is everi English chįld, as cempard with uther children, tu bė mulcted in two er thrė yėrs ev his lįf in erder tu lern it? Or thė lower clases tu go thru scūl withaut lerning tu rėd and rįt ther ōn languag inteligentli? And is thė cuntri tu pa milyons everi yėr fer this uter falūr ev nashunal edūcashun? I du net believ er think that such a stat ef things wil bė alaud tu go en forever, particūlarly as a remedy is at hand. I censider that thė sūner it is takn in hand thė beter. Ther is a motiv pauer behįnd thės fonetic reformers which Archbishop Trench has hardly takn intu acaunt. I mėn thė misery endūrd by milyons ev children at scūls hu mįt lern in wun yėr, and with rėal advantag tu themselvs, whot they nau requįr fōr er fįv yėrs tu lern, and seldom sucçėd in lerning after ōl.

The Philological Society of England has taken up the reform in earnest. In May, 1880, it appointed a committee to report a list of words in which etymology or history is falsified or obscured by the present spelling. Their report was dicussed at several meetings, amended, and adopted. It is now issued as a pamphlet entitled "Partial corrections of English spellings aproovd by the Philological Society." Classes of words are specified first like those of the American Spelling Reform Association mentioned on pp. 15 and 16. An alphabetical list of special words whose immediate amendment is recommended will be given in an appendix to this paper.

A British Spelling Reform Association was organized in 1879, with a formidable array of university professors, members of Parliament, chairmen of school boards, and eminent authors like Tennyson and Darwin among its officers. They have a salaried secretary and will issue a monthly paper.

The National Association of Great Britain for the Promotion of Social Science had this matter before them in a paper by Professor Newman, read to the congress at Cheltenham, in October, 1878. It was referred to the Education Department, which raised a special committee upon it, who have given it much attention and finally passed unanimously a resolution in favor of an alternative method of spelling. They say:

Such an alternativ method wud bė at wunç ūsful: 1st. For indicating thė pronunçiashun ov eni wurd or nam that ma not bė familyar tu ordinari rėders. 2d. For tėching thė proper pronunçiashun ov wurds in scūls, and thus cūring vulgarisms. 3d. For representing diferent dialects or individūal pecūliaritis. 4th. For showing thė pronunçiashun ov foren languages. This alternativ method, if generali apruvd, wud gradūali becum a concurent method, and perhaps eventūali wud displaç thė present iregūlar speling (just as thė Arabic nūmerals hav generali displaçt thė Roman nūmerals). In thė mėn tim it wud serv tu indicat thė direcshun in which eni parshal reforms ov thė curent speling shud bė mad.

They are in doubt about a suitable authority to initiate action. It will be remembered that our memorials to Congress contemplate a joint commission from the governments of the English speaking nations to decide this matter.

There are two important publications now at hand which call for such a decision: the great Historical Dictionary of the English Philological Society and the amended version of the English Bible. The dictionary has now been more than twenty years in making. The material accumulated for it is spoken of by tons' weight. The University of Oxford has now undertaken to print it, and the first volume will appear in 1882.

It will be one of the great books of the world, a standard work for generations. Dr. Murray, president of the Philological Society, who is its editor, wishes to put the key pronunciation in an agreed form of spelling. It is worth agreeing for. If it is agreed upon and establisht in the dictionary, we may well hope to see an edition of the new translation of the Bible speedily issued in it. And then we may fairly say that the reform stands on an establisht system and method, like the metric system of weights and measures, and we shall have nothing further to do but push it into use.

Meantime it would seem that authors and publishers might find the Philological Associations sufficient authority for the immediate use of such reformed spelling as they think to be reasonable and economical. Authors and editors are authority to the masses.

FORERUNNERS.

In the preceding sketch the present movement has been spoken of as a birth of time, an expression of the spirit of the age seeking to ameliorate the condition of man and to improve everything improvable; but there are a few men whose influence has been important enough to deserve especial mention as forerunners.

Dr. Franklin and Noah Webster were earnest reformers. Webster's dictionary and the controversies about its amended spelling produced a deep and lasting impression on the minds of the people. Those who saw the endings *ick* and *our*, as in *musick* and *honour*, give way to *ic* and *or*, know that more improvements can be made. Spelling reform has a natural alliance with phonetic stenography. The famous inventor of this system, Isaac Pitman, has also a system of phonetic printing. It was devised in connection with A. J. Ellis, esq., the most eminent of the scholars of England for his researches in early English pronunciation. They brought it to good working condition in 1845. It was speedily introduced into this country by S. P. Andrews, and widely promulgated, through the press and lectures, by Andrews, Longley, Parkhurst, Ben. Pitman, and others. They did not succeed in commending their schemes to the favor of the literary public, and finally in the war times all vestige of their labor seemed to be swallowed up and lost. Meantime, Dr. Edwin Leigh invented a series of modified types by which words can be presented phonetically without destroying their resemblance to their forms in the old spelling. He has printed many of the common primers and readers with these types and his books have been widely used in our best schools. They save a year or more in learning to read and are natural forerunners of amended spelling. It is now evident that the ready response to the deliverances of the philologists in 1874 and the rapid progress of the reform ever since are in great part due to the labors of these earlier reformers.

APPENDIX A.

SPECIAL WORDS APROOVD OF BY THE PHILOLOGICAL SOCIETY OF ENGLAND.

(*Words givn merely as exampls ar not included in this list.*)

Above: abuv.
abuse, *vb.*: abuze.
accoutre: acouter.
ache: ake.
achieve: acheev.
add: ad.
adjourn: ajurn.
affront: afrunt.
aghast: agast.
ague: agu.
aisle: aile.
amphitheatre: amfitheater.
anchor: anker.
approve: aproov.
apologue: apolog.
apse: aps.
are: ar.
argue: argu.
attorney: aturney.
awe: aw.
axe: ax.
aye: ay.

Bade: bad.
beauty: beuty.
behove: behoov.
believe: beleev.
bier: beer.
bomb: bom.
borough: buroh.
bought: boht.
bourgeon: burgeon.
bread: bred.
breadth: bredth.
breakfast: brekfast.
breast: brest.
breath: breth.
brief: breef.
brought: broht.
burgh: burg.
butt: but.

Canoe: canoo.
catalogue: catalog.
centre: center.
chamomile: camomile.
chief: cheef.
choir: quire.
choler: coler.
cholera: colera.
cinder: sinder.
cleanly: clenly.
cleanse: clenz.
close, *vb.*: cloze.
collapse: colaps.
colleague: colleag.
colour: culor.
come: cum.
comfit: cumfit.
comfrey: cumfrey.
comfort: cumfort.
companion: cumpanion.
company: cumpany.
compass: cumpass.
conjuror: cunjuror.
constable: cunstabl.
could: coud.
country: cuntry.
couple: cupl.
couplet: cuplet.
courage: curage.
cousin: cuzin.
covenant: cuvenant.
cover: cuver.
covet: cuvet.
covey: cuvey.
crumb: crum.

Dead: ded.
deaf: def.
dearth: derth.
death: deth.
debt: det.
debtor: detter.
decalogue: decalog.
delight: delite.
demesne: demene.
demagogue: demagog.
dialogue: dialog.
diffuse: difuze.
discomfit: discumfit.
disprove: disproov.
double: dubl.
doubt: dout.
dove: duv.
dozen: duzen.
dread: dred.
dreamed: dremt.
dumb: dum.

Earl: erl.
early: erly.
earn: ern.

earnest: ernest.
earth: erth.
ebb: eb.
eclogue: eclog.
egg: eg.
endeavour: endevor.
enough: enuf.
epilogue: epilog.
err: er.
excuse, *vb.*: excuze.
expence: expense.
eye: ey.

Feather: fether.
feign: fein.
field: feeld.
fiend: feend.
fierce: feerse.
flourish: flurish.
foreign: forein.
fought: foht.
friend: frend.
frieze: freez.
front: frunt.

Gamboge: gambooge.
ghost: gost.
give: giv.
glimpse: glimps.
gone: gon.
govern: guvern.
grease, *vb.*: greaz.
grief: greef.
grieve: greev.
guarantee: garantee.
guard: gard.
guardian: gardian.
guess: gess.
guest: gest.
guild: gild.
guilt: gilt.

Harangue: harang.
have: hav.
haughty: hauty.

head: hed.
health: helth.
heard: herd.
hearken: harken.
hearse: herse.
heart: hart.
hearth: harth.
heaven: heven.
heavy: hevy.
height: hiht.
hence: hense.
honey: huney.
house, *vb.*: houze.

Improve: improov.
inn: in.
island: iland.
isle: ile.

Jealous: jelous.
jeopardy: jepardy.
journal: jurnal.
journey: jurney.
joust: just.

Lamb: lam.
lapse: laps.
lead: led.
league: leag.
leant: lent.
learn: lern.
leaped: lept.
leather: lether.
leaven: leven.
leopard: lepard.
lief: leef.
liege: leege.
limb: lim.
live: liv.
lose: looz.
love: luv.
lustre: luster.

Meadow: medow.
meant: ment.

measure: mezure.
melancholy: melancoly.
metre: meter.
mien: meen.
mitre: miter.
money: muney.
mongrel: mungrel.
monk: munk.
monkey: munkey.
monologue: monolog.
mouse, *vb.*: mouze.
move: moov.
mystagogue: mystagog.

Nephew: neveu.
niece: neece.
nitre: niter.
nourish: nurish.
numb: num.

Ochre: ocher.
odd: od.
ogre: oger.
once: onse.
ought: oht.
owe: ow.

Parliament: parlament.
pearl: perl.
peasant: pezant.
pedagogue: pedagog.
pence: pense.
people: peple.
pheasant: fezant.
piece: peece.
pier: peer.
pierce: peerce.
pleasant: plezant.
pleasure: plezure.
plover: pluver.
plumb: plum.
plumber: plummer.
pommel: pummel.
priest: preest.
prologue: prolog.

prove: proov.
purr: pur.

Quay: key.
queue: cue.

Read: red.
ready: redy.
realm: relm.
redoubt: redout.
receipt: receit.
refuse, *vb.*: refuze.
rehearse: reherse.
relief: releef.
relieve: releev.
reprieve: repreev.
reprove: reproov.
retrieve: retreev.
rhyme: rime.
rough: ruf.

Saltpetre: saltpeter.
scarce: scarse.
scent: sent.
sceptic: skeptic.
sceptre: scepter.
school: scool.
scimitar: cimitar.
scissors: cissors.
scourge: scurge.
scythe: sithe.
search: serch.
sepulchre: sepulcher.
shield: sheeld.
shoe: shoo.
shove: shuv.
shovel: shuvel.
shriek: shreek.
siege: seege.
sieve: siv.
since: sinse.
some: sum.
son: sun.
sought: soht.
source: sourse.
southerly: sutherly.
southern: suthern.
sovereign: soverein.
spectre: specter.
sponge: spunge.
spread: spred.
sprightly: spritely.
stead: sted.
steady: stedy.
stealth: stelth.
stomach: stumac.
stomachic: stumachic.
subtle: sutl.
succumb: sucum.
sweat: swet.
synagogue: synagog.

Theatre: theater.
thence: thense.
thief: theef.
thieve: theev.
thorough: thuroh.
though: tho.
thought: thoht.
thread: thred.
threat: thret.
threaten: threten.
through: thru.
thumb: thum.
thyme: time.
tier: teer.
tierce: teerse.
ton: tun.
tongue: tung.
touch: tuch.
tough: tuf.
treachery: trechery.
tread: tred.
treadle: tredl.
treasure: trezure.
trouble: trubl.

Vineyard: vinyard.

Wealth: welth.
weapon: wepon.
weather: wether.
were: wer.
whence: whense.
whirr: whir.
whole: hole.
wholly: holely.
wield: weeld.
women: wimen.
won: wun.
wonder: wunder.
worm: wurm.
worry: wurry.
worse: wurse.
worship: wurship.
worst: wurst.
worth: wurth.
wrought: wroht.

Yearn: yern.
yeoman: yoman.
yield: yeeld.

Zealous: zelous.

APPENDIX B.

LITERATURE OF SPELLING REFORM.

AMERICAN Philological Association.—*Proceedings*—1874, see March (F. A.); 1875, see Trumbull (J. H.); 1876, 1877, see Haldeman (S. S.), reports of Committee on Spelling Reform.—*Transactions;* 1877-'78, articles in new types. *Hartford.* $2 per volume.

BLACKMER (O. C.). The Little Folks: an illustrated periodical printed in new types. *Chicago.* 30c. per year.

BROOMELL (G. D.). Phonetic Spelling. A paper read before the Principals' Association. *Chicago.* (2d.) 10c. per dozen.

BURNS (E. B.). The Spelling Reformer. Issued monthly. "No new letters." 50c. a year.—The Anglo-American Alphabet, 5c.; Primer, 15c. *New York.*

ELLIS (A. J.). Three Lectures on Glossic. 10c. each.—Pronunciation for Singers. A complete account of the phonetic elements in English, German, Italian, and French, with exercises and keys. *London.* 3s. 6d.—Reading Aloud. A lecture. *London.* 4d.—Early English Pronunciation. Containing an investigation of the correspondence of writing with speech in England, from the Anglo-Saxon period to the present day. The great thesaurus of this subject. 5 parts: 10s. each. *Trübner & Co., 57 and 59 Ludgate Hill, London.*—Orthography in Relation to Etymology and Literature. A lecture. 6d., 12c.—Plea for Phonetic Spelling (a summary of). 2d., 10c. per dozen.

FONETIC TECHER, T. R. Vickroy, editor. Organ of the Spelling Reform Association. *St. Louis.* 50c. a year. Bound volume for 1880, 50c.

GLADSTONE (J. H.). The Spelling Reform. *London.* 50c.

GOODWIN (T. A.). The Duty of Literary Men. An address at the Indiana Asbury University. 50c. a dozen. *Burns, New York.*

HADLEY (J.). Is a Reform desirable in the Method of Writing the English Language? In "Philological and Critical Essays." *Holt & Co., New York.* $5.

HALDEMAN (S. S.). Analytic Orthography. *Philadelphia: J. B. Lippincott & Co.*—Address before the Spelling Reform Association. In Bulletin for October, 1876.—President's Address before American Philological Association. In Proceedings for 1877. *Hartford, Conn.*

HARRIS (W. T.). An Address before the Spelling Reform Association at St. Louis, January, 1878. In January Bulletin. 5c.

JONES (E.). Spelling and School Boards. *Liverpool.* 4d. per dozen.—The Revision of English Spelling a National Necessity. *Liverpool.* 1s.

LATHAM (R. G.). A Defence of Phonetic Spelling. *London.* 1s. 6d.

LEIGH (E.). Sound Charts.—Primers.—Fresh Leaves. *New York.*

LONGLEY (A.). The Phonetic Educator. Monthly. Pitman letters modified. $1.50 a year.—Charts; Readers; Dictionary. $4. *St. Louis.*

MARCH (F. A.). President's Address before the American Philological Association. *Hartford.* 10c.—Opening Address before the International Convention for the Reform of English Orthography. *Philadelphia,* 1876. 10c.—Abstract in Bulletin of Spelling Reform Association for April, 1878.—Orthography. Articles in Cyclopædia of Education and Year Book of Education, 1877. *New York.*—The Condition of Spelling Reform. Transactions of the American Institute of Instruction, 1878; same subject, Proceedings of the National Educational Association, 1879; same in same, 1880.—The Relation of Educators to Spelling Reform, in same volume.—Spelling Reform, from an etymological and philological point of view, *Princeton Review,* pamphlet article, No. 19. 5c.—An A B C Book. *Boston.*

MÜLLER (F. Max). Spelling. *Fortnightly Review,* April, 1876. Reprints. 8d. per dozen. See also passages in Lectures on the Science of Language, Vols. I, II; Chips from a German Workshop, Vols. I, II, IV. *Scribner & Co., New York.*

MURRAY (J. A. H.). Spelling Reform. President's address to Philological Society of England, 1880. *London.*

PARKHURST (H. M.). The Plowshar: a periodical exemplifying Spelling Reform. *New York.*

PAUL (G. H.). Report to Legislature of Wisconsin, 1879. *Madison, Wis.*

PITMAN (I). The Phonetic Journal. Weekly, 1d.; monthly, 5d. *Bath, England.*—A Plea for Spelling Reform. A series of tracts, compiled from periodicals, recommending an enlarged alphabet and a reformed spelling of the English language. 33 tracts bound in one volume. 8d. *Bath,* 1878.

SAYCE (A. H.). In his *Introduction to the Science of Language. London.*

SKEAT (W.). See letters below in ENGLISH PERIODICALS.

SPELLING Reform Association. Proceedings of the International Convention for the amendment of English Orthography, held at Philadelphia, August, 1876. 20c.—Bulletins 1876–1880, bound in one volume. 50c. *T. R. Vickroy: St. Louis, Mo.* See FONETIC TECHER.

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SWEET (H.) A Hand-book of Phonetics. *London: Clarendon Press.* $1.75.

TRUMBULL (J. Hammond). President's Address before the American Philological Association, July, 1875. In *Proceedings.*

VAILE (E. O.). Pro and Con of Spelling Reform. An Address before the Ohio State Teachers' Association, July, 1877. *New York.* 50c. per dozen.

VICKROY (T. R.). A Fonetic Furst Reder. *Cincinnati.* See FONETIC TECHER.

WHITNEY (W. D.). How shall we Spell? In *Oriental and Linguistic Studies*, 2d series.—The Elements of English Pronunciation, and other papers; in same series. *New York: Scribner & Co.* $2.50.—Language and the Study of Language. Same publishers. $2.50.—Life and Growth of Language. *New York: D. Appleton & Co.* $1.50.

WITHERS (G.). The Spelling Hindrance in Elementary Education. *Liverpool.* 6d.—Alphabetic and Spelling Reform an Educational Necessity. *Liverpool.* 1s.—The English Language Spelled as Pronounced. *London: Trübner & Co.* 1s.

THE AMERICAN PERIODICALS.

Papers from E. A. H. Allen. *The New-England Journal of Education*, May 3, 1877.—O. C. Blackmer. *Educational Weekly*, July 5, 1877.—B. F. Burnham. *The New England*, March 18, 25, 1876.—Arthur Gilman. *Atlantic*, March, 1878; *The Wide Awake*, February, 1881.—*The Graphic*, frequent good editorial notes.—Thomas Hill. *The New England*, March 1, 1877.—*The Home Journal*, reprint of F. W. Newman's "English Languages as Spoken and Written," May 27, April 3, 1878. A Broadside of Opinions of 100 educators, authors, and scholars, April 14, 1880.—T. C. Leland. *The New-York Tribune*, May 20, 1875. —T. R. Lounsbury. *Scribner's Monthly*, September, October, 1879.—F. A. March. *The Princeton Review*, *The Independent*, *The Nation*, *Good Literature*.—Richard Grant White. *The Galaxy*, July, September, October, 1875; April, July, September, 1876. *The New-York Times*, 1877.—H. M. Whitney. *The Round Table*, December, 1877, April, 1878.—W. D. Whitney, F. A. March, and others. *The Independent*, 1880, 1881.

IN ENGLISH PERIODICALS.

Letter from Rev. Walter Skeat. *Athenæum*, April 29, 1876.—Letters from Mr. A. J. Ellis, Mr. Hyde Clarke, and Mr. James Spedding. *Athenæum*, May 6, 1876.—Letter from Rev. Walter Skeat. *Athenæum*, May 27, 1876.—Letter from Mr. Russell Martineau. *Spectator*, December 30, 1876.—Letter from Mr. Henry Sweet. *Academy*, February 24, 1877.—Letters from Mr. A. J. Ellis. *Academy*, March 3, March 10, and March 17, 1877.—Letter from Rev. A. H. Sayce. *Academy*, March 10, 1877.—Two Letters from Mr. James Spedding. *Academy*, June 2 and 9, 1877.—Three Letters from Mr. A. J. Ellis. *Academy*, June 16, 23, and July 9, 1877.

GERMANY.

VERHANDLUNGEN der zur Herstellung grösserer Einigung in der deutschen Rechtschreibung Konferenz. *Berlin*, January, 1876.

REFORM. Organ des alg. fereins. *Bremen.* 2 marks a year.

ZEITSCHRIFT für Orthographie. *Rostock.* 3 marks a half year.

APPENDIX C.

OFIÇERƧ OV ÞHE SPELING REFORM ASOSHIƟSHUN FOR 1880-'81.
(Founded 1876.)

President.—Francis A. March, LL. D., professor of English language and comparative philology, Lafayette College; ex president of the American Philological Association, Easton, Pa.

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